MODIFICATION NOTE INDEX
LASER BEAM CEILOMETER

Number	Date of Issue	Title
1	February 27, 1987	laser Beam Ceilometer (LBC) Technical Information Package (TIP)
	November 27, 1987	Amendment 1 to Maintenance Note 50 (LBC TIP)
2	December 21, 1989	Final Operation and Maintenance Instructions Technical Manual for Laser Beam Ceilometer
3	June 9, 1990	Replacement of the Laser Beam Ceilometer (LBC) Heater Foil
4	May 29, 1991	Setting a New Laser Normal Power (LNOR) Value
5	May 30, 1991	Correction of the Procedure for Replacement of A1
6	May 29, 1992	Corrections to the Technical manual Operation and Maintenance instruction Laser Ceilometer CT12K REV “E”

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

W/OS0321 - FLP

February 27, 1987

TO: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-8 Distribution)

FROM: W/OS03 - J. Michael St. Clair

SUBJECT: Transmittal Memorandum for Engineering Handbook No. 8, Issuance 87- 1

1. Material Transmitted:

Engineering Handbook No. 8, Surface Equipment, Section 2.5; Maintenance Note 50: Laser Beam Ceilometer (LBC) Technical Information Package (TIP).

2. Summary:

Maintenance Note 50 provides information for the installation and maintenance of the Laser Beam Ceilometer (LBC).

3. Effects on Other Instructions:

None.

EHB-8
Issuance 87-1

MAINTENANCE NOTE
(for Electronics Technicians)

50. Laser Beam Ceilometer (LBC) Technical Information Package (TIP)

This TIP provides information on installation, maintenance, and logistics policies for the LBC.

NATIONAL WEATHER SERVICE

Engineering Division

Silver Spring, Maryland

LASER BEAM CEILOMETER

(LBC)

TECHNICAL INFORMATION PACKAGE

February 1987

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

GENERAL

The National Weather Service (NWS) is procuring a microprocessor-controlled, laser-based system known as the Laser Beam Ceilometer (LBC). The LBC system will replace all current NWS Rotating Beam Ceilometer (RBC) systems.

The LBC system consists of the following major assemblies:

Field Site - A pedestal-mounted Main Equipment Assembly (MEA). The MEA houses both the transmitter and receiver with associated optics and electronics assemblies,

Office Location - The Gifft recorder presently in use with the RBC will be retained as the display device.

SYSTEM CONCEPTS

The LBC transmits short laser light pulses. Clouds are detected by measuring backscattered laser energy.

The height of the clouds is determined by measuring the elapsed time between the transmission and the reflected echos. This measuring sequence provides updated cloud information every 12 seconds. The system is designed for an operating range of up to 12,000 feet above ground level.

The system provides a trigger break signal (0 degree) and a gated 120-Hz cloud signal for normal Gifft recorder operation. These outputs interface directly to the Gifft recorder Field Junction Box (FJB).

SYSTEM DELIVERY

The first systems will be delivered to field locations that have exhibited the highest "down time" based on NWS-wide EMRS data. All regions will receive at least one LBC from the initial production lot.

All sites have been assigned a system by serial number. Any relocations should be closely coordinated with the Surface System Program Leader to assure proper equipment configuration.

RBC DISPOSITION

The RBC field equipment should be retained on station. Each region will use these units as a source of parts in support of the remaining RBC's in operation.

Final disposition instructions will be forwarded when all RBC systems have been replaced.

SECTION 2

SAFETY PRECAUTIONS

EYE SAFETY

The laser power level is continuously monitored and adjusted by the system to the safety standards of the unaided human eye. The following general precautions should be observed during the servicing and maintenance of the instrument.

DO NOT LOOK DIRECTLY INTO THE TRANSMITTER BEAM DURING OPERATION

NEVER LOOK DIRECTLY INTO THE TRANSMITTER WITH MAGNIFYING GLASSES OR BINOCULARS

AVOID DIRECT EXPOSURE TO THE LASER BEAM RADIATION

VOLTAGE PRECAUTIONS

The Line Voltage Lamp (DS1) only indicates that AC line voltage is connected to the MEA. It does NOT indicate that power is applied to the subassemblies.

Power for the subassemblies is controlled by the Measuring Equipment (CB1) and Window Conditioner (CB2) circuit breakers. No indication, other than a visual inspection, is provided to show that the circuit breakers are ON.

AC line voltage is easily removed from the MEA by disconnecting the AC line supply connector (31) on the base of the unit.

Caution should be exercised during servicing and maintenance, as high voltage is accessible when the covers are removed and the unit is powered.

TRANSMITTER SAFETY

The transmitted laser light is not visible to the human eye. Proper laser operation cannot be verified by viewing the laser diode assembly. Attempting to do so by operating the unit with the Transmitter PCB (A7) removed from the optics assembly may result in permanent eye damage. Use of the Maintenance Terminal (K220-2) to obtain the LLAS value is the correct procedure to verify laser transmission.

SECTION 3

MAINTENANCE POLICIES

MAINTENANCE RESPONSIBILITIES

Upon commissioning, maintenance of the LBC system is the responsibility of the electronics technicians (el techs) at the station, or other el techs so designated by the regional headquarters.

ON-SITE REPAIRS

The basic field repair will be fault isolation to the line replaceable unit (LRU), replacement of the LRU, and shipment of the failed LRU to the National Reconditioning Center (NRC).

TEST EQUIPMENT

No special test equipment is required for maintenance of the LBC. The Maintenance Terminal (K220-2) is the primary device used to communicate and troubleshoot the LBC. The Maintenance Terminal is a LRU and is supplied with each system.

SPECIAL TOOLS

All hardware in the system is metric. A small selection of tools and replacement hardware is provided in the field spares kit. If additional hardware or tools are required, they should be purchased locally.

STAFFING POLICIES

Replacement of the RBC with the LBC will not result in any position upgradings. Existing grade structures at those stations receiving the equipment will remain the same.

Staffing requirements will not be increased as a result of the LBC installation. The estimated workload for the LBC system, including the Gifft recorder, is .06 staff-year.

SECTION 4

LOGISTICS POLICIES

STATION SPARES

The laser ceilometer was designed to have a mean time between failures (MTBF) of 1 year. With this expected low failure rate, no spare LRU's will be stocked on station.

A field spares kit will be provided with each system. The kit consists of expendable items such as fuses, hardware, touch-up paint, and metric tools.

LOGISTICS SUPPORT SYSTEM (LSS)

All LRU's for the LBC are available from LSS inventory at the National Logistics Supply Center (NLSC). The purpose of LSS is to provide resupply of critical, costly components while maintaining close control of the location of each part. This system reduces the time and paperwork involved in requisitioning parts.

There is no charge (except transportation) to the sites for ordering, so long as all defective repairable parts are promptly returned to NRC.

Refer to Part 0 of Engineering Handbook 1 (EHB-1) for instructions on LSS requisitioning procedures.

WARRANTY

There is a 1-year warranty on all LBC's. NRC is responsible for LRU tracking and determining warranty repairs. The station technician will follow normal LSS ordering procedures for replacement LRU's, regardless of warranty status.

SECTION 5

DOCUMENTATION

EQUIPMENT MANUALS

The LBC manufacturer has prepared an equipment manual which includes fault isolation procedures consistent with NWS maintenance philosophy. One manual will be shipped with each system.

MAINTENANCE SCHEDULE

The Interim Maintenance Schedule is contained in section 5 of the LBC equipment manual. This will be used as guidance in the maintenance of the LBC until a formal maintenance schedule is published for EHB-8.

EMRS REPORTING

The Laser Beam Ceilometer system is reportable equipment. All maintenance should be reported using "LBC" as the equipment reporting code.

Report activation of the LBC system in accordance with procedures detailed in EHB-4.

Report deactivation of the RBC system in accordance with procedures detailed in EHB-4.

All failed LRU's returned to NRC should have a WS Form A-23 attached. The el tech should enter all pertinent information according to procedures detailed in EHB-4.

PROPERTY MANAGEMENT

The station manager of the site receiving the LBC should submit a NOAA Form 37-21, Personal Property Management Record, in accordance with procedures detailed in the NOAA Directives Manual.

A NOAA Form 37-21 should not be submitted on the deactivated RBC until final disposition instructions have been forwarded.

ENGINEERING HANDBOOK 1

The ordering information for all LBC LRU's will be added to EHB-1. Until EHB-1 has been updated, use the following part numbers and descriptions when ordering.

WSSN	Description	NSN
K220-1A1	Data Processor Vaisala P/N 70-2681	6660-00-000-4286-X
K220-1A2	Unreg P/S Vaisala P/N 70-2682	6130-00-000-0000-X
K220-1A3	Output Interface Vaisala P/N 70-2683	6660-00-000-8080-x
K220-1A5	Light Monitor Vaisala P/N 70-2685	6660-00-000-6500-X
K220-1A6	Receiver Vaisala P/N 70-2686	5820-00-000-0000-X
K220-1A7	Transmitter Vaisala P/N 70-2687	5820-00-000-0023-X
K220-1PS1	HV P/S Vaisala P/N 70-2688	6130-00-000-0004-X
K220-1TS1	Temp Sensor Vaisala P/N 70-2689	6660-00-000-8923-X
K220-1T1	Temp Control Xfr Vaisala P/N 70-2714	6660-00-444-0000-X
K220-1K1	Solar Shutter Vaisala P/N 70-2713	6660-00-838-0000-X
K220-1R1	Temp Ctrl Heater Vaisala P/N 70-2712	6660-00-375-0005-X
K220-1W3	Output Harness Vaisala P/N 70-2693	6660-00-000-6669-X
K220-1B1	Window Cond Vaisala P/N 70-2737	6660-00-000-7201-X
K220-2	Maint Terminal Vaisala P/N 70-2690	6660-00-000-6111-X

The LBC system (K220) consists of the Main Electronics Assembly (K220-1), Maintenance Terminal (K220-2), and Gifft recorder (K220-3).

When ordering items for the Gifft recorder (K220-3) use WSSN K211-A4.

SECTION 6

TRAINING

FACTORY TRAINING

A factory training course was conducted for NWS maintenance personnel at the contractor's facilities in Woburn, MA. Personnel were designated by the regions to attend this training.

Assistance in resolving initial problems after installation is available by contacting the Regional Headquarters through the AES.

FORMAL TRAINING

A limited technical training program will be established at the NWS Training Center (NWSTC). This training will become part of the Surface Instruments Maintenance Training (SIMT), X-02-04, course.

ON-THE-JOB TRAINING

The initial installation and check-out procedures will provide limited maintenance experience. This experience, in addition to the procedures contained in the LBC equipment manual, will enable the el tech to perform the required field maintenance and repair.

SECTION 7

INSTALLATION OVERVIEW

PHYSICAL CHARACTERISTICS

The Main Equipment Assembly (MEA) of the LBC system is housed in a rectangular metal cabinet that is pedestal mounted. The MEA, when mounted on the pedestal, is 53 inches high and weighs 123 pounds.

SITE LOCATION

The MEA will be located at the RBC detector site, unless otherwise required, using the existing concrete base and associated cables.

The RBC projector site will no longer be required for equipment location. Due to existing cable configurations, some sites may require cross connections at the RBC projector site to complete cable routing to the LBC.

BASE REQUIREMENTS

The RBC detector base can be adapted for the installation of the MEA. Refer to the attached installation drawing (figure 7-1) for the recommended procedure.

If a new concrete base is required, recommended dimensions are given in figure 7-2.

BASE ORIENTATION

In the Northern Hemisphere the receiver end of the MEA should be oriented North. In the Southern Hemisphere the receiver end of the MEA should be oriented South. This will help reduce sunlight induced noise.

SOLAR SHUTTER REQUIREMENT

Field sites located between 30 degrees North and 30 degrees South latitude will be equipped by the factory with a solar shutter assembly. The solar shutter is designed to protect the laser diode assembly from direct sunlight.

CAUTION: DUE TO OPTICAL FOCUSING OF THE SYSTEM, THE LASER DIODE ASSEMBLY MAY BE PERMANENTLY DAMAGED BY EXPOSURE TO DIRECT SUNLIGHT.

POWER REQUIREMENTS

The field site requires AC power of 115 V +/-10%, 45-65 Hz, 800 W (7 A) maximum for the Main Equipment Assembly (MEA) and 20 A maximum for a convenience outlet.

The AC connection to the MEA is through J1 on the base of the assembly.

A rain-tight AC outlet will need to be provided at the LBC field site. The does not contain an AC convenience outlet.

EARTHING REQUIREMENT

For proper ceilometer transient protection (Noble Gas Surge Arrestors) a proper external ground connection must be made to the "earthing" terminal on the MEA base. Follow all local codes regarding proper equipment grounding. A 6 foot, 5/8 inch diameter ground rod (minimum) is recommended at the LBC field site.

SIGNAL LINE REQUIREMENTS

All signal lines are electrically floating. Noble gas surge arrestors between each line and ground provide over-voltage protection of 300-500 V.

The system is designed for a line length of approximately 8 miles of good condition lines. All existing field cables should meet the following resistance limits:

Minimum resistance between conductors and to ground on all lines is 100,000 ohms.

Maximum control line loop resistance is 20,000 ohms. If this resistance is exceeded, the 0 degree pulse will be attenuated, resulting in erratic Gifft recorder operation.

If a new field cable installation is required, an 8 conductor (minimum), twisted pair, AWG 18 signal line is recommended.

INTERFACING REQUIREMENTS

The LBC system will use the RBC Gifft recorder as the display device. The synchronous detector option in the Gifft recorder must be disabled. Refer to section 5-10 in the Gifft recorder manual for the correct jumper positioning on the receiver PCB.

The LBC system uses a time measurement, not the angular degrees of rotation and trigonometric relationship of the RBC system, to determine cloud height. The LBC produces an output signal compatable with the Gifft recorder. Due to the digital processing performed, a new angular look-up table is provided for the LBC system. This table is in section 1.3 of the LBC equipment manual, and a copy should be provided to the operations personnel.

INTERCONNECTIONS

The existing RBC control and power cables between the field site and the office location should be used when possible. Due to existing cable configurations, some sites may require cross connections at the RBC projector site to complete cable routing to the LBC.

Refer to figure 7-3 for a simplified drawing of the system interconnections.

Field Site

The AC line from J1 on the base of the MEA to the field cable should be fabricated locally. Use the power connector, type MS 3116-F12-3S, provided with each unit.

The signal line from J3 on the base of the MEA to the field cable should be fabricated locally. Use the signal connector, type MS 3116-F12-8S, provided with each unit.

The connector pin assignments and cable recommendations are given in figure 7-4.

Both cables should be routed from the appropriate jacks on the base of the MEA, through the pedestal, to the field cables. The required lengths may vary between sites.

Office Location

The control line from the field site should be connected to the (+) and (-) terminals of the Gifft recorder Field Junction Box (FJB).

NOTE: The control line is no longer polarity sensitive.

The signal line from the field site should be connected to the (S) terminals (Short Baseline) on the FJB. The long baseline connections will no longer be used.

EQUIPMENT SECURITY

If the equipment is not in a secure location, it is recommended that the MEA site be secured with a chain link fence enclosure. The field of view (top) of the MEA must not be obstructed.

At airports or other locations where the equipment is in a secure area, the MEA cover can be secured to the pedestal with padlocks. The base of the MEA has holes near the equipment cover latches for this purpose.

SECTION 8

RECEIVING INSTRUCTIONS

RECEIVING INFORMATION

The LBC shipment will consist of the following items:

1. Main Equipment Assembly (MEA)
2. Pedestal for the MEA
3. Equipment Manual (1)
4. A field spares kit
5. Maintenance Terminal (1)
6. Installation hardware
7. Equipment Quality Assurance and S/N documentation.

The items will be packed in two wooden containers and shipped by common carrier to the station.

VISUAL INSPECTION - PACKAGING

When the LBC shipment is received, inspect the exterior of the shipping containers. If the shipping containers show signs of damage, the contents must be inspected before the carrier departs. The extent of the damage must be noted on the carrier's Bill of Lading before the delivery acknowledgement is signed. The el tech should notify WSH Engineering Division through the Regional Headquarters of equipment receipt and any damage noted. Any damaged items will be held on station pending disposition instructions from WSH.

UNPACKING

The shipping containers are provided with disassembly instructions. These instructions give the proper sequence to open the containers without damaging the instrument.

Carefully remove the components from the shipping containers. Retain the packing material that is inserted over the optics. This material will be used to protect the optics when maintenance is performed on the MEA.

Check all shipping containers to ensure that all items have been removed.

CAUTION: The MEA without pedestal weighs 103 lbs. Use care when unpacking.

Extreme care should be exercised when moving the MEA assembly. The optics have been factory aligned and can not be adjusted at the field site.

VISUAL INSPECTION - EQUIPMENT

Visually inspect all components for cracked or damaged PCB's, missing parts, or any other signs of damage.

Reference marks have been put on the focusing rings on the base of the transmitter and receiver optics. Verify that this alignment has not changed during shipment. The covers on the transmitter and receiver must be removed to view the reference marks. If the focusing has changed during shipment contact WSH through the region for disposition instructions.

CAUTION: Insert the protective packing material over the transmitter/receiver optics before performing the hardware installation.

SECTION 9

INSTALLATION PROCEDURE

MEA BENCH TEST

The MEA should be tested prior to installation. This will ensure that the LBC is functional before removing the operational RBC system.

1. Carefully place the MEA on the bench with the covers removed and verify the following items:

   a. Proper jumper placement on the PCB's. Refer to drawings CT2277 and A.CT 4307 in section 4 of the LBC equipment manual.

   b. Proper internal cable connections. Refer to drawing U.CT1104.

   C. Proper seating of all PCB's.

   d. Record the Laser Normal Value (LNOR) from the tag on the Transmitter PCB (A7). This value will be used during the MEA performance verification.

2. Fabricate an AC power cable using the connector pin assignments given in figure 7-4.

3. Verify that the Measurement Equipment (CB1) and Window Conditioner (CB2) circuit breakers are in the OFF (down) position.

4. Verify that the AC line voltage is between 103 V and 126 V at the AC Line Supply connector (J1).

WARNING: THE LINE VOLTAGE LAMP DS1 WILL BE ON WHEN AC POWER IS CONNECTED TO THE MEA. THERE ARE NO INDICATORS TO SHOW THAT THE CIRCUIT BREAKERS ARE ON.

5. Connect the power connector to J1 and the window conditioner to J2 on the MEA base. The location of the connectors is given on drawing A.CT 3306 in section 4 of the LBC equipment manual.

6. Use section 10 (SYSTEM PERFORMANCE VERIFICATION) of this TIP, and test the MEA. Steps 6 and 7 of the MEA PERFORMANCE VERIFICATION procedure cannot be completed without a Gifft recorder.

CAUTION: To prevent damage to the MEA, the unit should be repacked in the original container before transporting the unit to the field site.

Do not continue the LBC installation until the MEA has been successfully bench tested.

SITE PREPARATION

1. Remove the RBC detector and projector.

2. If required, make cross connections at the RBC projector site to complete cabling to the LBC.

3. Verify. field cable condition. Resistance limits are given in section 7 (SIGNAL LINE REQUIREMENTS) of this TIP.

4. Terminate the field cables at the LBC site.

All connections should be completed in raintight enclosures for proper cable protection.

After all connections have been completed, ensure that power has been removed from all unused lines.

HARDWARE INSTALLATION

Field Site

1. Install the pedestal for the Main Electronics Assembly (MEA) on the concrete base with the hardware provided.

2. Install the MEA on the pedestal with the hardware provided. Refer to section 7 (BASE ORIENTATION) of this TIP for proper receiver positioning.

CAUTION: The MEA weighs 103 lbs. Two people should be used to position the unit on the pedestal.

3. Connect the signal and power cables for the MEA to the field cables.

4. Place a spirit level across the top of the transmitter/receiver castings on the MEA assembly. Level the unit in both directions to within +/- 3 degrees.

5. Verify that the Measurement Equipment (CB1) and Window Conditioner (CB2) circuit breakers are in the OFF (down) position.

6. Verify that the AC line voltage is between 103 V and 126 V at the AC Line Supply connector (31).

WARNING: THE LINE VOLTAGE LAMP DS1 WILL BE ON WHEN AC POWER IS CONNECTED TO THE MEA. THERE ARE NO INDICATORS TO SHOW THAT THE CIRCUIT BREAKERS ARE ON.

7. Connect the power connector to J1 and the signal connector to J3 on the MEA base. The location of the connectors is given on drawing A.CT 3306 in section 4 of the LBC equipment manual.

HARDWARE INSTALLATION

Office Site

1. Verify that the Gifft recorder FJB is properly connected to the control and signal lines from the field. Refer to section 7 (INTERCONNECTIONS) of this TIP.

2. Verify that the Gifft recorder synchronous detector option has been disabled. Refer to section 7 (INTERFACING REQUIREMENTS) of this TIP.

SECTION 10

SYSTEM PERFORMANCE VERIFICATION

MAINTENANCE TERMINAL USE

The Maintenance Terminal will be the device used by the el tech for communicating with the MEA. Before the following tests are performed, the el tech should become familiar with the Maintenance Terminal operation, system commands, and operating modes. This information is contained in section 3 of the LBC equipment manual.

NOTE: For easy reference, a table of commands and input sequence is contained in the cover of the maintenance terminal.

EQUIPMENT POWER-UP

Remove the packing material that is installed over the transmitter and receiver optics.

If required, clean the optics using the procedure in section 5.2 of the LBC equipment manual.

CAUTION: Use only the cleaning materials provided in the field spares kit. Commercial cleaning fluids may damage the optical coatings.

NOTE: The windows in the MEA cover are optically ground and coated on both sides.

Turn on the measuring equipment circuit breaker (CB1). Using the LEC indications on the Data Processor PCB (A1), verify the start of operation sequence. The proper LED indications are given below.

D4 (Red LED) - D4 lights for approximately 5 seconds while the system is performing an internal reset.

D5 (Green LED) - After D4 has turned OFF, D5 starts blinking once per second. This indicates that the system software is operating normally. D5 does NOT indicate that the system is in the normal operating mode (AUTO ON).

Turn the Window Conditioner (CB2) circuit breaker to the ON (up) position. Install the MEA cover. Install the Window Conditioner and connect the Window power cable to J2 on the MEA.

NOTE: The Line Voltage Lamp (DS1) will be on when AC power is connected to the MEA. There are no indicators to show when the circuit breakers are on.

MEA PERFORMANCE VERIFICATION

Allow 30 minutes for the system to stabilize before performing the following verifications.

1. Connect the Maintenance Terminal to J4 on the base of the MEA.

NOTE: The following parameters are stored in an EEPROM on the Data Processor PCB (A1). These parameters can be changed accidently through improper use of the Maintenance Terminal. They are not automatically reset to the correct values by restarting the system. Ensure that all parameters are set to the values given below. FAILURE TO DO SO MAY RESULT IN ERRONEOUS CLOUD DETECTION OR EQUIPMENT OPERATION.

2. Using the parameter command (PAR), verify that the system parameter settings are as follows:

PARAMETER	VALUE OR STATUS
CLIM	0.0100
SLIM	0.4990
DEV	0.9980
NSCA	2.9882
SCAL	19.8902
LNOR	This value is different from unit to unit. It should be set to the value given on the tag on the Transmitter PCB (A7).
EMOD	OFF
DATA UNIT	FT
RMOD	O N
BMOD	OFF

3. Using the alarm limit command (ALIM), verify that the system alarm limits are the same as shown in section 3.3.2.a of the LBC equipment manual.

NOTE: The Alarm Limit (ALIM) values are not stored in the EEPROM. The factory values are used as initial limits after every restart.

4. Using the status command (STA), verify that the system readings are within the following tolerances.

SIGNAL	LIMITS
P10D	+6 V.....+10 V
P20I	+17.5 V.....+24.5 V
M20I	-16.5 V.....-23.5 V
P25V	+22.0 V.....+30.0V
M20A	-16.5 V.....-23.5 V
P20A	+16.0 V..... +23.0 V
P12M	+9.5 V.. .....+14.5 V
P10X	+7.5 V.. .....+11.5 V
PXHV	+120 V.....+200 V
P10R	+7.5 V.....+11.5 V
MRHV	-230 V.....-390 V
LLAS	.9(LNOR) .. ..1.02(LNOR)
LSKY	0.....4
GND	0.....2
TL	-5 Deg C....+20 Deg C from ambient
TE	-5 Deg C.....+5 Deg C from ambient
TI	-5 Deg C. . ..+20 Deg C from ambient
TB	-5 Deg C....+20 Deg C from ambient

5. Using the AUTO command, place the MEA in the maintenance mode (AUTO OFF).

NOTE: The Gifft recorder must be configured as detailed in section 7 (INTERFACING REQUIREMENTS) of this TIP before performing the next test.

6. Using the recorder test command (RECT), initiate a recorder output test.

Verify the presence of test markings on the Gifft recorder.

To terminate the test press ABORT (A key on the maintenance terminal).

NOTE: The LBC output signal level is jumper selectable (+5, +2, 0, -2 dBm) on the Output Interface PCB (A3). The system has been factory set to +2 dBm. Tests were conducted with a worst case -2 dBm output level, and the system was capable of driving over 15 miles of simulated 22 ga. telephone line. The Gifft recorder will operate correctly with extremely low input signal levels. If the test signal is not present suspect incorrect system cabling.

7. Using the AUTO command, place the unit in the normal operating mode (AUTO ON).

NOTE: The system will NOT transmit the normal 12-second measuring sequence unless the system is placed in the normal operating mode (AUTO ON).

The check-out procedure is now complete and the system should be operational.

SECTION 11

MAINTENANCE AIDS

TROUBLESHOOTING TECHNIQUES

The value of the Maintenance Terminal can not be overstated. This is the device the el tech will use to control and troubleshoot the MEA.

The use of the Maintenance Terminal to obtain the system status message should be the first step in any system fault diagnosis. There are 10 status indicators (S1-S10) in the status message that provide a quick check of the system.

The status message and guidelines contained in section 6 of the LBC equipment manual will provide the el tech with the necessary information to diagnose, verify, and replace failed LRU's in the MEA.

In addition to the troubleshooting procedures given in section 6 of the LBC equipment manual, the following information may aid in locating equipment faults and understanding equipment operation.

1. When maintenance is performed that requires the system to be placed in the maintenance mode (AUTO OFF), the system will NOT transmit the normal 12-second measuring sequence. The system MUST be placed in the AUTO ON mode for normal operation.

2. Several LED's are located on the Output Interface PCB (A3). These indicators are useful in troubleshooting.

D10, D11, and D12 are status indicators for the built-in modem and are not used in the NWS Gifft recorder configuration.

D13 (RBCT) will light, and relay (K1) can be heard, each time a O-degree pulse for the Gifft recorder is transmitted by the MEA. If these actions do not occur, it may indicate that the system is not in the AUTO ON mode. D14 (RBCE) will light when a cloud signal is detected and transmitted to the Gifft recorder by the MEA.

3. The system is capable of transmitting a recorder test by use of the RECT command. The system must be in the maintenance mode (AUTO OFF) to run this test, which can be used as a quick check of line condition and Gifft operation.

NOTE: Be sure the system is placed back in the AUTO ON mode after testing is complete.

The Window Conditioner blower does not run continuously during normal operation and can not be used as an indication of blower condition. The blower should be on when any of the following conditions exist:

a. Calculated cloud data indicates that clouds do exist:

b. Visibility is low due to fog or rain, causing misty windows;

C. External temperature (TE) is below -10 degrees C or above +30 degrees C.

If none of the above conditions exist, the blower will cycle on for 5 minutes each hour.

5. When the HV power supply (PS1) or the Receiver PCB (A6) is changed, the receiver high voltage (MRHV) must be adjusted (R13 on the HV P/S). MRHV is temperature sensitive and changes at a linear rate of 1.5 V/Deg C. The tag on the receiver PCB gives the value for MRHV with the system stabilized at 25 deg C. For other temperatures a correction must be applied. To determine the correction use the following procedure.

CAUTION: THIS PROCEDURE MUST NOT BE PERFORMED DURING INCLEMENT WEATHER CONDITIONS.

a. Apply power to the system and allow 30 minutes for the system to stabilize to ambient temperature WITH THE COVERS REMOVED.

b. Use the status command (STA) and obtain the laser temperature (TL).

C. Use drawing CT4559 and determine the temperature compensated MRHV (TC MRHV) value.

Adjust MRHV to the value determined in step c (TC MRHV). The Maintenance Terminal can be used to monitor the MRHV voltage during this adjustment.

NOTE: The unit must be in the normal operating mode (AUTO ON) during the following procedure. This will update the MRHV value every 12 seconds.

Use the status command (STA) and step the terminal to the MRHV status line. The MRHV status line is not automatically updated by each 12 second scan. The terminal must be stepped forward (F key), and then back (B key) to update the display. R13 should be adjusted, and the maintenance terminal display updated, after every 12 second scan.

6. Fuses F3 and F8 on the Unregulated Power Supply PCB (A2) are marked with the British value of .63 amps. The U.S. fuses used are rated for .6 amps. All other fuses are marked correctly.

7. An OFFSET CALIBRATION procedure must be done when certain items are replaced in the MEA. A list of these items and the offset calibration procedure is given in section 6.4 of the LBC equipment manual.

8. If the Transmitter PCB (A7) or the Data Processor PCB (Al) is replaced, the value for LNOR indicated on the Transmitter PCB must be placed in the system operating software (equipment parameters table). This is done with the LNOR command.

9. The PROJECTOR OK lamp on the Gifft recorder will flash if any of the first four status indicators (S1 - S4) in the status message are set. This indicates a system failure, and the el tech should investigate and correct the problem.

10. An unlit PROJECTOR OK lamp on the Gifft recorder indicates that a trigger break (0 degree) signal is not present.

11. Use care when replacing the Transmitter (A7) or Receiver (A6) PCBs. The focusing adjustment can be moved when the hardware retaining the PCBs is removed. The focusing is a factory alignment and can not be done at the field site.

12. The heater in the Window Conditioner unit will not come on unless the blower is running.

13. The transmitter high voltage (PXHV) is temperature dependent. The values for PXHV displayed on the Maintenance Terminal (K220-2) may vary. PXHV is regulated and temperature compensated on each transmitter board. No adjustment is required when changing the Transmitter PCB (A7).

14. The system, if installed per this TIP, is wired for short baseline control and operation by the Gifft recorder. If the baseline switch is placed in the "long" position, the recorder will sweep, but no clouds will be printed.

15. Diagnostics are performed each time the system is powered up or reset. Error messages generated during these diagnostics will be momentarily displayed on the Maintenance Terminal (K220-2) before the status message. The error messages can not be displayed by use of the status command (STA). Diagnostics can be initiated by performing a RESET command, using the reset switch (S1) on the Data Processor PCB (A1), or by momentarily interrupting AC power. Section 6.1.1.1 of the LBC equipment manual lists the error messages and the suspect LRU.

16. Use care when removing the Transmitter (A7) PCB. The laser diode mounting screw on the bottom of the PCB can be easily damaged. It is recommended that a piece of foam rubber be placed between the diode mounting screw and the base of the unit when loosening the PCB mounting nuts. If the diode mounting screw is damaged or moved in any way, the transmitter must be returned to the NRC for repair.

SIGNAL DESIGNATIONS

The following list of signals and their designations will assist the el tech in maintenance of the LBC system.

DESIGNATION	SIGNAL
P10D	+10 VDC Logic Supply
P20I	+20 VDC Output Interface Supply
M20I	-20 VDC Output Interface Supply
P25V	+25 VDC Shutter/Heater Supply
M20A	-20 VDC Analog Supply
P20A	+20 VDC Analog Supply
P12M	+12 VDC Maintenance Terminal Supply
P10X	+lO VDC Transmitter Low Voltage Supply
PXHV	Transmitter Positive High Voltage Supply
P10R	+10 VDC Receiver Low Voltage Supply
MRHV	Receiver Negative High Voltage Supply
LLAS	Laser Power
LSKY	Ambient Light Level
GND	Offset ground for A-D Converter
TL	Laser Diode Temperature
TE	External Ambient Temperature
TI	Internal Ambient Temperature
TB	Blower Temperature

NOTE: ORIENT THE PEDESTAL SO THE CABLE OPENINGS FACE THE RAINTIGHT ENCLOSURE AND THE RECEIVER END OF THE MEA IS POINTED NORTH IN THE NORTHERN HEMISPHERE.

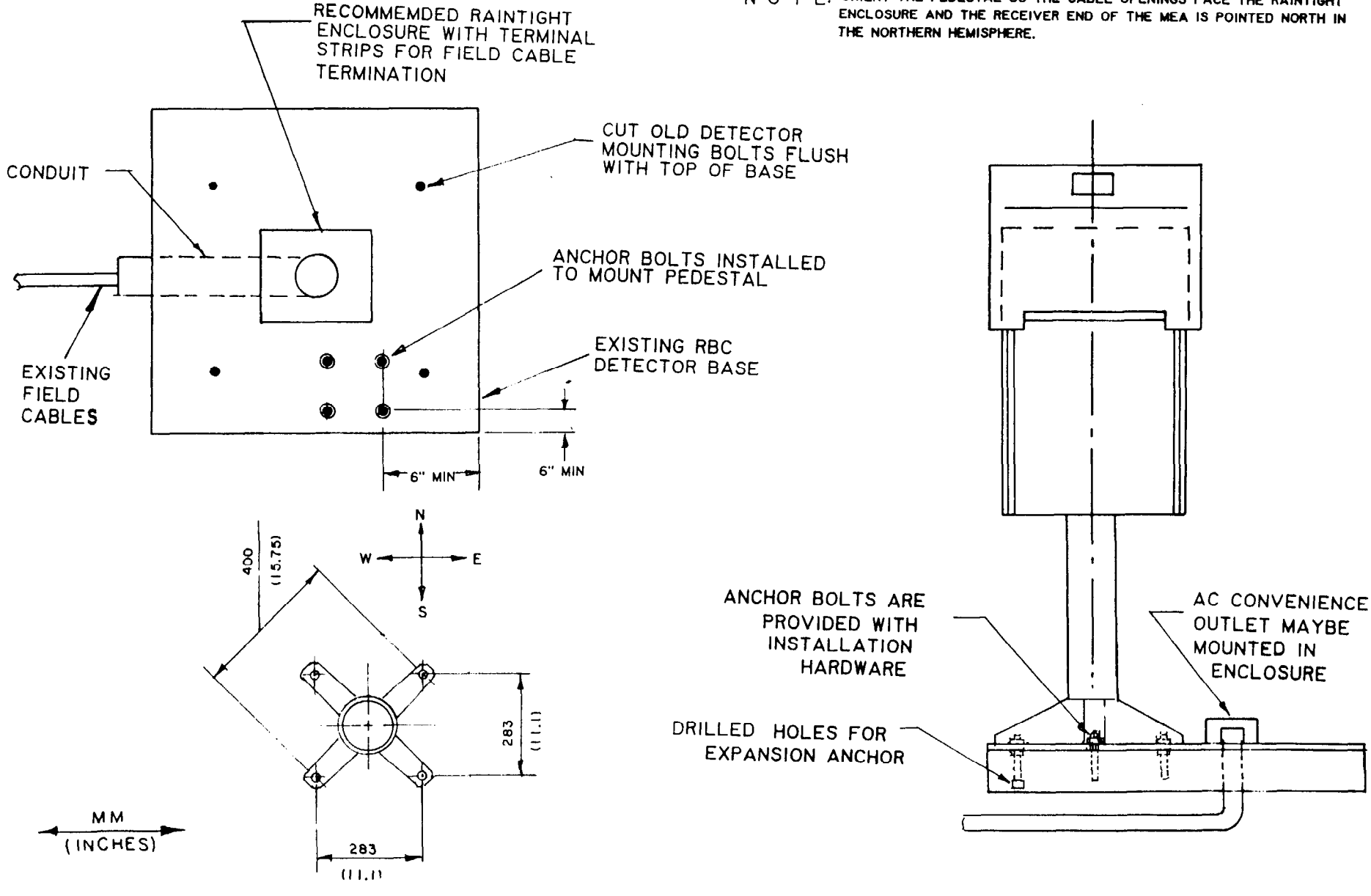


FIGURE 7 - 1

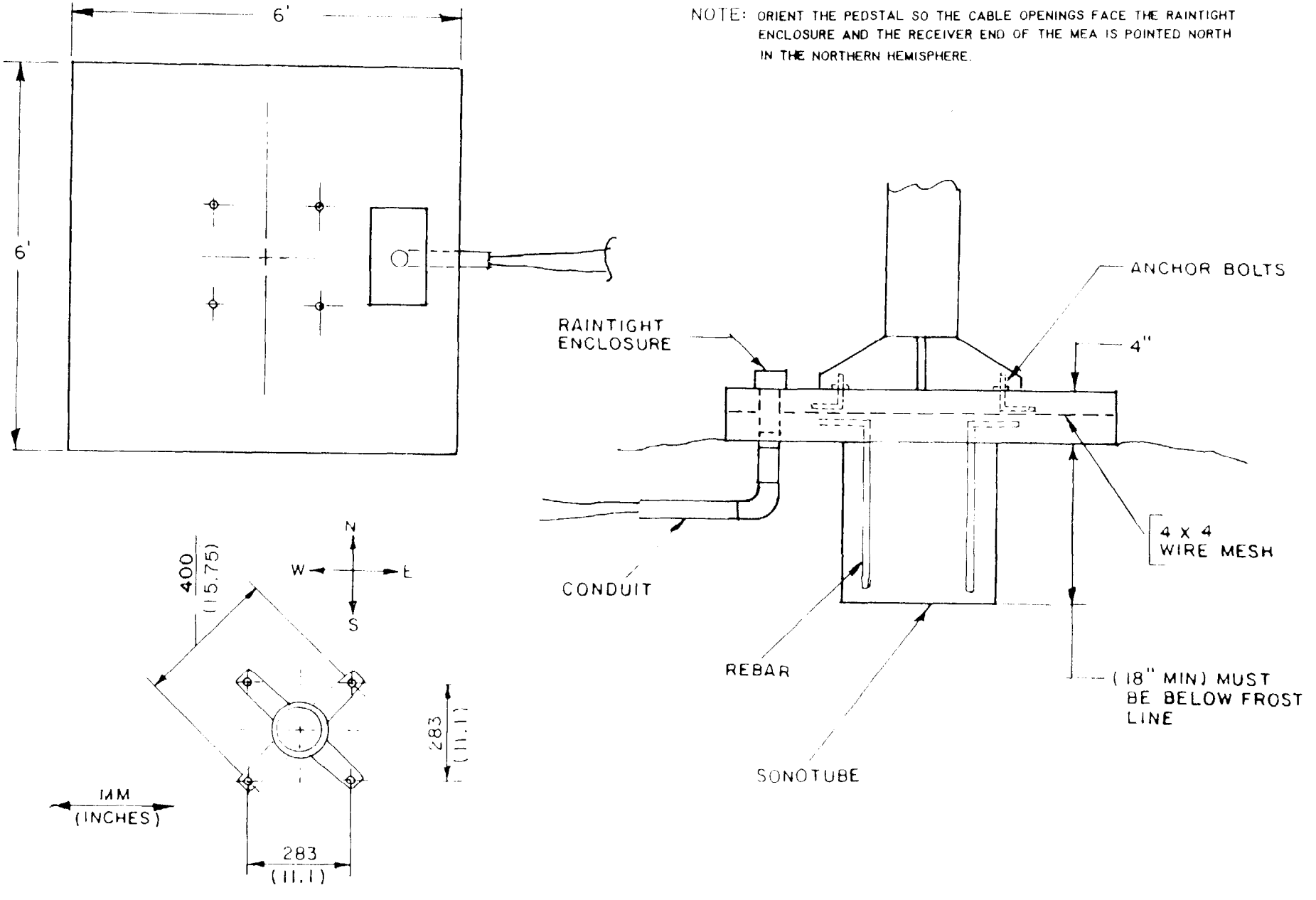

6'
6'
NOTE: ORIENT THE PEDSTAL SO THE CABLE OPENINGS FACE THE RAINTIGHT ENCLOSURE AND THE RECEIVER END OF THE MEA IS POINTED NORTH IN THE NORTHERN HEMISPHERE.
RAINTIGHT ENCLOSURE
ANCHOR BOLTS
4"
4 X 4 WIRE MESH
CONDUIT
REBAR
(18" MIN) MUST BE BELOW FROST LINE
SONOTUBE
N
W
E
S
400 (15.75)
283 (11.1)
283 (11.1)
MM (INCHES)

FIGURE 7-2

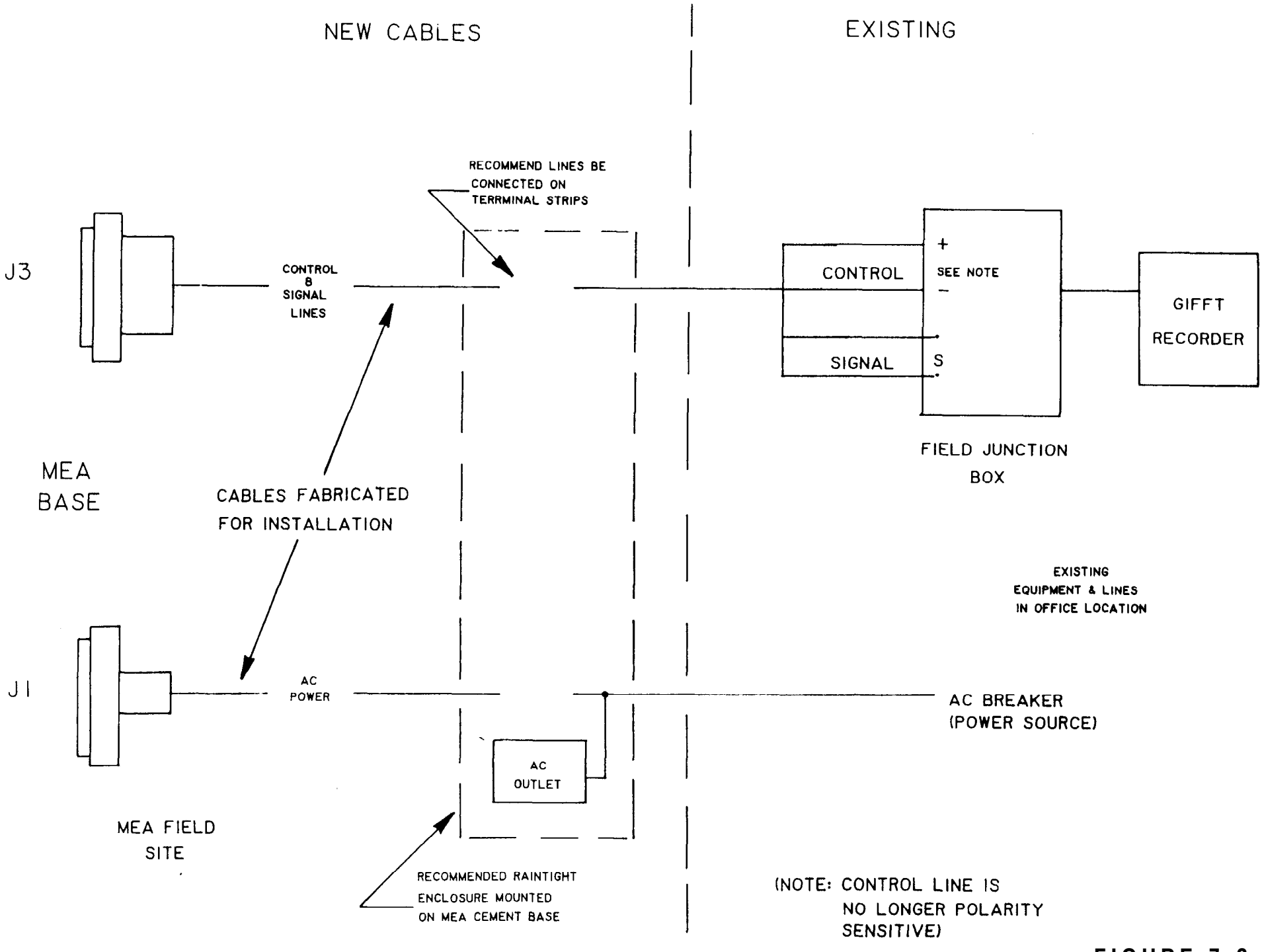

NEW CABLES
EXISTING
RECOMMEND LINES BE CONNECTED ON TERRMINAL STRIPS
J3
CONTROL & SIGNAL LINES
CONTROL
SIGNAL
+
SEE NOTE
–
S
GIFFT RECORDER
FIELD JUNCTION BOX
MEA BASE
CABLES FABRICATED FOR INSTALLATION
EXISTING EQUIPMENT & LINES IN OFFICE LOCATION
J1
AC POWER
AC BREAKER (POWER SOURCE)
AC OUTLET
MEA FIELD SITE
RECOMMENDED RAINTIGHT ENCLOSURE MOUNTED ON MEA CEMENT BASE
(NOTE: CONTROL LINE IS NO LONGER POLARITY SENSITIVE)

FIGURE 7-3

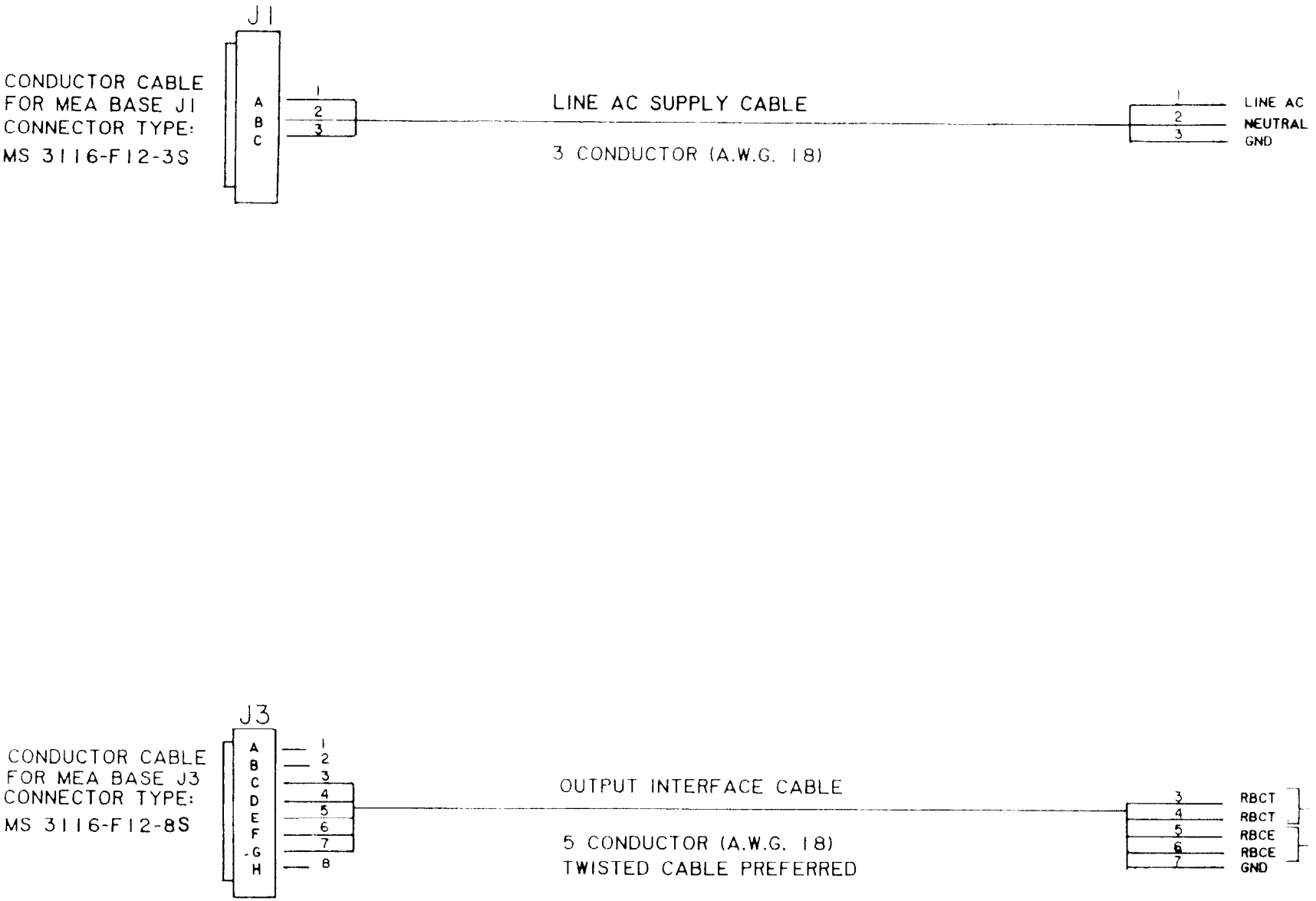

J1
CONDUCTOR CABLE
FOR MEA BASE J1
CONNECTOR TYPE:
MS 3116-F12-3S
A
B
C
1
2
3
LINE AC SUPPLY CABLE
3 CONDUCTOR (A.W.G. 18)
1
2
3
LINE AC
NEUTRAL
GND
J3
CONDUCTOR CABLE
FOR MEA BASE J3
CONNECTOR TYPE:
MS 3116-F12-8S
A
B
C
D
E
F
G
H
1
2
3
4
5
6
7
8
OUTPUT INTERFACE CABLE
5 CONDUCTOR (A.W.G. 18)
TWISTED CABLE PREFERRED
3
4
5
6
7
RBCT
RBCT
RBCE
RBCE
GND
TRIGGER
SIGNAL

FIGURE 7- 4

AMENDMENT 1 TO MAINTENANCE NOTE 50 (for Electronics Technicians)
Engineering Division
W/OSO321:TEC

Laser Beam Ceilometer Technical Information Package

General

1. Summary: Amendment No. 1 updates the Laser Beam Ceilometer (LBC) Technical Information Package (TIP).

2. Effect on Other Instructions: Place an asterisk in the margin before each section in the TIP revised by this amendment.

Introduction

This amendment provides both new and additional information regarding the installation and maintenance of the LBC.

Shipments of the LBC resumed in August of 1989 after a break in production of over a year. The production break allowed significant improvements to be made in the performance of the LBC. The improvements provide much more consistent detection and reporting of cloud and vertical visibility occurrences.

The improvements are incorporated in both software and hardware changes. The software changes are included in the new version of system operating software, Version 2.42. The hardware changes are improved laser diodes for the transmitter which will provide longer life and a new receiver PCB with improved temperature compensation and on-board voltage regulation. The improved temperature compensation gives much better control of receiver sensitivity with temperature variation. The transmitter changes will not affect installation or maintenance procedures. The effects of the new software and receiver board are discussed in the TIP.

Existing LBC's will be upgraded with the new receiver board and Version 2.42 software in the near future.

Revision D of the Technical Manual is the latest manual and incorporates the changes addressed in this TIP. All stations will receive a copy of revision D when available.

Procedure

Implement the changes on the following pages.

Section 5

Page 6

Change the Vaisala P/N for the K220-1A5 light monitor board to 70-10322.

Add Vaisala P/N 70-20105 for the K220-1A6 receiver board having on-board temperature monitoring and voltage regulation. Reference to the old board will be kept until they are no longer in use.

Section 7

Page 9

Change the last sentence in the INTERFACING REQUIREMENTS to read, "The basic, table is in section 1.3 of the LBC Technical Manual. Operations personnel are responsible for making a unique table for each location which takes into account the difference between the height of the LBC and the height of the airport and gives the user an encoded cloud height value."

The height offset (HOFF) capability of the LBC is for future use of the LBC in an automated system and is to be set to 0 when used as an RBC replacement.

Section 9

Page 13

Para. 1.a. Change drawing "A.CT 4307" to "A.CT 4407."

Para. 5. Change "A.CT 3306" in section 4 to "A.CT 3406" in section 2.

Page 14

Para. 7. Change "A.CT 3306" in section 4 to "A.CT 3406" in section 2.

Add paragraph 8: The AC line voltage should-also be verified under full LBC load conditions. Ensure that the window conditioner is connected. Switch CB1 and CB2 circuit breakers to the ON position. With the LBC in the maintenance mode, command the blower on and the heater on. Check that the blower operates. Verify that the AC line voltage at the MEA side of J1 is between 103V and 126V. If not, improvements must be made to the AC supply to get the AC voltage in that range under full load conditions.

Section 10

Page 17

Para. 2. For units with software Version 2.42, the system parameter settings are as follows:

PARAMETER	VALUE OR STATUS
CLIM	0.10
SLIM	0.20
DEV	This value is different from unit-to-unit. It should be set to the value in the equipment documentation.
NSCA	4.5
SCAL	100.0
TOTA	10.0
RAT	3.7012
HOFF	0
EMOD	Off
DATA UNIT	FT
RMOD	ON
BMOD	OFF
LNOR	This value is different from unit to unit. It should be set to the value given on the transmitter PCB

Page 18

Para. 3. Change "Section 3.3.2.C" to "Section 3.4.4."

Page 19

Para. 6. Replace paragraph 6 with the following:

Using the recorder test command (RECT), perform a recorder output test and an LBC control lines check. Verify the presence of a test pattern on the GIFFT similar to figure 10.1. If the test signal is not present, suspect incorrect system cabling. Note the starting position of the left-most test pattern. A starting location of more than 0.5" before the 0" line indicates an unacceptable LBC control line. Refer to figure 10.1. Area A shows an LBC control line well within the 0.5" limit. Area B shows an LBC control line at the limit of acceptability. If the LBC control line is unacceptable, appropriate steps must be taken to get an acceptable line.

NOTE: The LBC output signal level is jumper-selectable (+5, +2, 0, -2 dBm) on the Output Interface PCB (A3). The system has been factory set to +2 dBm. Tests were conducted with a worst case -2 dBm output level, and the system was capable of driving over 15 miles of simulated 22-gauge telephone line. The Gifft recorder will operate correctly with extremely low input signal levels. If the test signal is not present, suspect incorrect system cabling.

To terminate the test, press ABORT (the A key on the hand-held terminal).

Section 11

Page 21

Para. 5. For LBC's with the original receiver PCB, Vaisala P/N 70-2686, this paragraph is still in effect.

All LBC's shipped after July 1989 have the revised receiver installed. Ensure that R13 on the HV P/S is turned to maximum output. All receiver boards in the Logistics Support System (LSS) are the revised type. When installing a replacement board from LSS, ensure that R13 on the HV P/S is turned to maximum output.

All existing LBC's will be modified with a revised board. Future production of LBC's will delete R13 on the HV P/S.

Section 11

Page 22

Para. 8. Replace paragraph 8 with the following:

If the Data Processor PCB (A1) is replaced, the LNOR value indicated on the transmitter PCB must be correctly placed -in the system operating software.

If the transmitter PCB (A7) is replaced, a new value for LNOR must be determined and placed in the system operator's software (equipment operating table) and on the transmitter PCB.

The Technical Manual calls for a method involving a diffuser to determine LNOR. An alternative method is given below to use until the diffuser is available and in lieu of the diffuser method when it is practical to get TL in the required temperature range. The alternative method is the normal method used at the factory and is the preferred method when practical.

Alternative Method for LNOR

Observe the value of TL. If it is 22° ± 4°, install the new transmitter PCB using the installation instructions in section 6.2.7 of the Technical Manual. If TL is not 22° ± 4°C, steps must be taken to obtain a TL of 22°C ± 4°C before installation. Installation may be held for more favorable ambient conditions or, in some cases, it may be necessary to move the LBC indoors.

After installation of the card, operate the LBC for a minimum of 30 minutes.

When TL is 22°C ± 4°C, continue with the following:

Set frequency to 3 in maintenance mode:

AUTO OFF
FREQ 3
LASE ON
SEQ ON

Observe value of monitored laser power, LLAS

AN LLAS or AN 8
(ESC to abort)

Insert LLAS value plus 5 as new LNOR value:

LNOR ([LLAS at freq 3] + 5)

Update LNOR value on the transmitter PCB and **station records.**

Replace covers. Perform offset calibration according to section 6.4. Set unit into Automatic Mode:

AUTO ON
CLOS

Continue with the last paragraph of section 6.2.7 in the Technical Manual.

Section 11

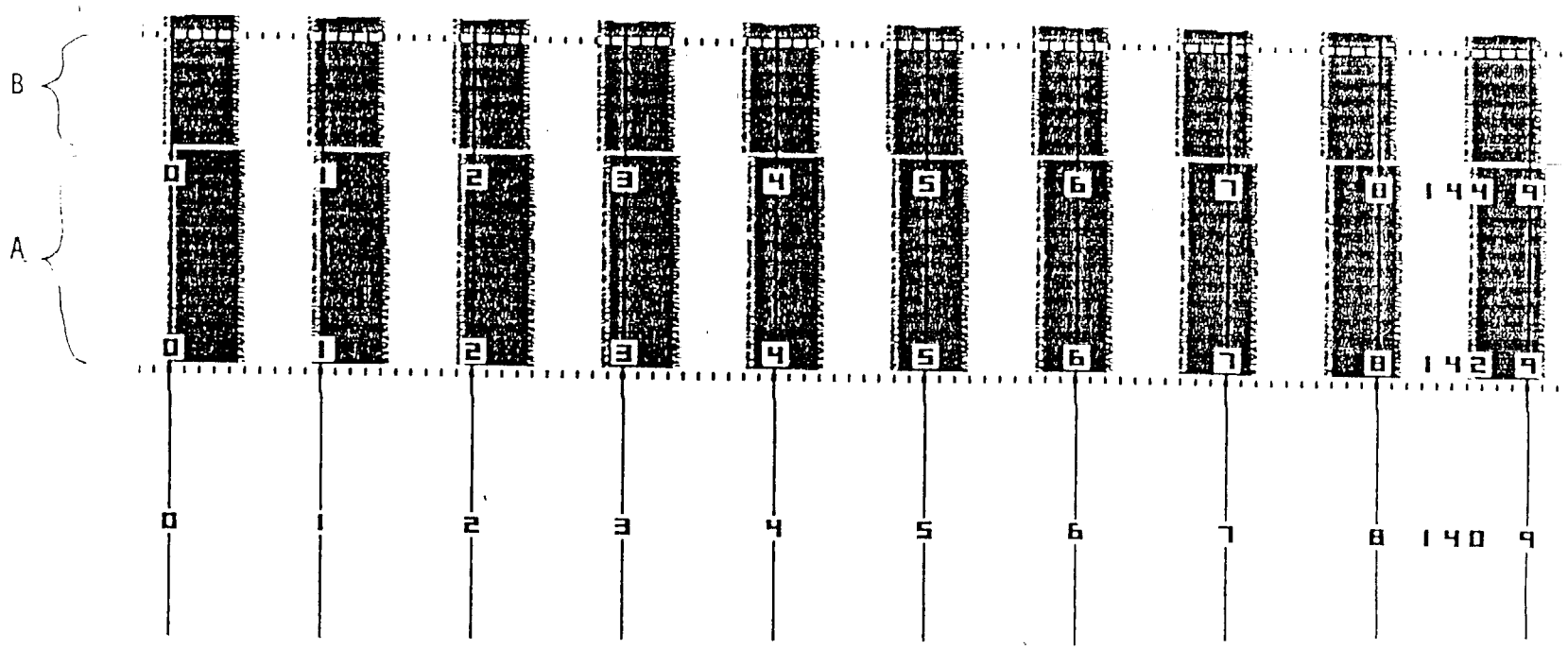
Add Paragraph 17.

Powering down the LBC while in the automatic mode with the line open will result in an "EEPROM ERROR" diagnostic when the LBC is powered up. The error is cleared by opening and closing the line.

Add Paragraph 18.

Occurrence of a laser frequency (FREQ) of 7 indicates a significant reduction in laser power output. It is recommended that the laser frequency be checked quarterly for such a condition and that its occurrence be reported to the Engineering Division for corrective action.

J. Michael St. Clair
Chief, Engineering Division



A - LBC control line well within limits
B - LBC control line at limit of acceptability

LBC CONTROL LINE CHECK
FIGURE 10-1

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

November 27, 1987

W/OS0321 - FLP

TO: All NWS Regional Headquarters, Area Electronics Supervisors, and Electronics Technicians (EHB-8 Distribution)

FROM: W/OS03 - J. Michael St. Clair

SUBJECT: Transmittal Memorandum for Engineering Handbook No. 8, Issuance 87-8

1. Material Transmitted:

Engineering Handbook No. 8, Surface Equipment, Section 2.1, Change No. 1 to Maintenance Note 50: Laser Beam Ceilometer (LBC) Technical Information Package (TIP).

2. Summary:

Maintenance update No. 1 provides updated pages 17 and 18 to be placed into the TIP.

3. Effect on Other Instructions:

The attached pages supercede previous instructions.

EHB-8
Issuance 87-8

MEA PERFORMANCE VERIFICATION

Allow 30 minutes for the system to stabilize before performing the following verifications.

1. Connect the Maintenance Terminal to J4 on the base of the MEA.

NOTE: The following parameters are stored in an EEPROM on the Data Processor PCB (A1). These parameters can be changed accidently through improper use of the Maintenance Terminal. They are not automatically reset to the correct values by restarting the system. Ensure that all parameters are set to the values given below. FAILURE TO DO SO MAY RESULT IN ERRONEOUS CLOUD DETECTION OR EQUIPMENT OPERATION.

2. Using the parameter command (PAR), verify that the system parameter settings are as follows:

PARAMETER	VALUE OR STATUS
CLIM	0.1500
SLIM	0.2500
DEV	1.0000
NSCA	3.0000
SCAL	20.0000
LNOR	This value is different from unit to unit. It should be set to the value given on the tag on the Transmitter PCB (A7).
TOTA	5.0000
EMOD	OFF
DATA UNIT	FT
RMOD	ON
BMOD	OFF

A copy of these parameters are enclosed with the printouts shipped with each unit.

3. Using the alarm limit command (ALIM), verify that the system alarm limits are the same as shown in section 3.3.2.a of the LBC equipment manual.

NOTE: The Alarm Limit (ALIM) values are not stored in the EEPROM. The factory values are used as initial limits after every restart.

4. Using the status command (STA), verify that the system readings are within the following tolerances.

SIGNAL	LIMITS
P10D	+ 6.5 V.....+10.0 V
P20I	+ 15.0 V.....+24.5 V
M20I	- 15.0 V.....-23.5 V
P25V	+ 20.0 V.....+30.0 v
M20A	- 15.0 V.....-23.5 V
P20A	+ 15.0 V.....+23.0 V
P12M	+ 8.0 V.....+14.5 V
P10X	+ 7.5 V.....+11.5 V
PXHV	+ 52.0 V.....+200.0 V
P10R	+ 7.0 V.....+11.5 V
MRHV	-150.0 V.....-390.0 V
LLAS	.9(LNOR).....l.O2(LNOR)
LSKY	0.....4
GND	0.....2
TL	-5 Deg C....+20 Deg C from ambient
TE	-5 Deg C.....+5 Deg C from ambient
TI	-5 Deg C....+20 Deg C from ambient
TB	-5 Deg C....+20 Deg C from ambient

ENGINEERING HANDBOOK 8 SECTION 2.4
MAINTENANCE NOTE 121 for Electronics Technicians)
Engineering Division
W/OSO321:BGM

Final Operation and Maintenance Instructions Technical Manual for the Laser Beam Ceilometer

General:

The final operation and maintenance instructions manual for the laser beam ceilometer has been published and distributed. The manual is identified as **Revision E - September 1989** on page iii in the manual. All technical manuals prior to Revision E are now obsolete.

Effect on Other Instructions:

All maintenance, modification, and calibration procedures; indexes; and drawings that refer to any revision other than Revision E of the technical manual are affected.

Procedure:

The final operation and maintenance instructions technical manual (Revision E) is currently being distributed to all NWS stations.

J. Michael St. Clair
Chief, Engineering Division

MAINTENANCE NOTE 3 (for Electronics Technicians)
Engineering Division
W/OS0321:BGM

Replacement of the Laser Beam Ceilometer (LBC) Heater Foil

General:

This maintenance note provides installation instructions for replacing a defective heater foil in the LBC heater subassembly. Stations that have reported a defective heater foil will receive a replacement heater foil.

Effects on Other Instructions:

None.

Procedure:

Follow this procedure to replace the heater foil.

NOTE: Before starting the installation, check the new heater foil by shorting wires 3 and 4 together. Use an ohmmeter to measure the resistance between the shorted pair and the wire marked # 5. The reading should be approximately 22 ohms; if not notify Bob McCormick, (301) 427-7835.

Removal

1. Remove AC from LBC.

2. Disconnect the J2 cable from the window conditioner unit.

3. Loosen screws and remove the window conditioner.

WARNING: Wear gloves when removing the window conditioner because of the sharp edges.

NOTE: The window conditioner should be moved indoors before attempting to replace the heater foil.

4. Remove the four screws holding the heater/blower subassembly to the window conditioner.

5. Locate the heater terminal block E1 and disconnect wires labeled 3, 4, and 5.

6. Remove the four nuts and washers from the screws holding the heater/blower subassembly to the heater base plate.

7. Remove the heater/blower from baseplate.

8. Slide the disconnected wires 3, 4, and 5 through the grommet. The tie wrap may have to be cut.

9. Remove the four nuts and washers from the screws holding the radiator. Make a note of the holes from which this hardware is removed.

10. Remove the two insulation plates from the heater foil.

11. Remove the heater foil from the radiator.

Installation

1. Put a light coating of thermal grease on the underside of the radiator. Ensure that the countersink holes for screws are filled with the thermal grease as this will help with the heat conduction.

2. Thread wires 3, 4, and 5 of the new heater foil through the grommet.

3. Locate the correct hole pattern that was noted in removal step 9. Position the new heater foil over the insulation plates and install the radiator on the baseplate with the screws, washers, and nuts removed in step 9.

4. Rewire the new heater foil into the heater terminal block El.

   a. Wires 3 and 4 connect to E1 terminal block position #3.
   b. Wire 5 connects to El terminal block position #5. Reference the connection diagram CT4290 in the Laser Beam Ceilometer Technical Manual Rev "E" for wiring assistance.

5. Use the screws removed in step 6 to install the heater/blower subassembly to the heater base plate.

6. Use the screws in removal step 4 and install the heater/blower into the window conditioner.

7. Install the window conditioner and connect J2.

8. Restore AC power.

J. Michael St. Clair
Chief, Engineering Division

Laser Beam Ceilometer MAINTENANCE NOTE 4 (for Electronics Technicians)
Engineering Division
W/OSO321:BGM

Setting a New Laser Normal Power (LNOR) Value

General:

This maintenance note describes the prerequisites for setting a new LNOR parameter for the Laser Beam Ceilometer (LBC).

Correct performance of the LBC depends on correct laser power. Correct laser power requires that the laser power be maintained constant at a standard output level. The LBC maintains constant laser power level by compensating for the temperature of the laser transmitter as well as monitoring laser power (LLAS) and changing the pulse repetition frequency to adjust laser power.

The light monitor board monitors the LLAS which is compared to the LNOR value. If LLAS is 2 or more greater than LNOR, then frequency is decreased by 1. If LLAS is less than LNOR by 20 or more, then frequency is increased by 1. The value of LNOR directly affects the laser power output level.

Effect on Other Instructions: None.

Procedure:

There are two methods for determining the correct LNOR values:

1) the Diffuser Method, reference paragraph 6.2.6, (p.294) of the *Technical Manual, Operation and Maintenance Instructions, Laser Ceilometer CT12K*
2) the Alternative Method, reference EHB-8, Section 2.5, Maintenance Note 1, for information.

Determining LNOR with either method requires a standard laser power output from the transmitter board that the factory has set for all units. Do not establish a new LNOR value unless standard laser power output is certain. An incorrect LNOR resulting in low laser power will decrease LBC performance. An incorrect LNOR resulting in high laser power will reduce the life of the laser.

A new LNOR value should be set only when: the LBC is first installed or when a new transmitter board from stock is installed to replace a defective one.

J. Michael St. Clair
Chief, Engineering Division

Laser Beam Ceilometer MAINTENANCE NOTE 5 (for Electronics Technicians)
Engineering Division
W/OSO321:BGM

Correction of the Procedure for Replacement of A1.

General:

This maintenance note corrects the procedure for the replacement of A1 and establishes the requirement for a Laser Normal Power (LNOR) log.

Effect on Other Instructions:

Correct the LBC Technical Manual by making the following pen and ink changes.

> Paragraph 6.2.1, Processor Board CTM 12, (p. 286), delete sentence from paragraph titled, Replacement of A1 "Set LNOR as described in Paragraph 6.2.6."

Procedure:

Set LNOR in the new processor board to the previous LNOR value when the parameter check of Paragraph 3.3, (Parameters and Operation Modes) (p.61), is performed. To do this, a log of the current value of LNOR must be maintained. The LNOR value for a new system is provided in the system documentation. The LNOR value for a replacement transmitter board is obtained by either of the two methods for determining LNOR, i.e., the diffuser method or the alternative method. The log value must be updated when LNOR is changed.

J. Michael St. Clair
Chief, Engineering Division

LBC MAINTENANCE NOTE 6 (for Electronics Technicians)
Engineering Division
W/OS0321:BGM

Corrections to the *Technical Manual Operation and Maintenance Instructions Laser Ceilometer CT12K* REV "E"

General:

This maintenance note provides corrections to the Technical Manual. The National Weather Service (NWS) replaced the CTR 12 receiver boards with CTR 13 receiver boards. The information in the Technical Manual about the CTR 12 receiver board does not apply to NWS-owned LBCs.

Effect on Other Instructions:

Correct the Technical Manual by making pen and ink changes.

Procedure:

Paragraph 4.3.7.3.3 - High-Voltage Outputs, pages 215-6, next to last paragraph: Change the output voltage temperature coefficients in the last sentence to read 1.5V/°F and 2.7V/°C. Add a note on pages 215 and 216 that only the next to last paragraph applies to NWS-owned LBCs.

Paragraph 6.2.7 - High-Voltage Power Supply CTP 12 Reference PS1, page 296, under the heading of Replacement, add a note that the information on the CTR 12 does not apply to NWS-owned LBCs.

J. Michael St. Clair
Chief, Engineering Division

MAINTENANCE NOTE INDEX - COOPERATIVE PROGRAM EQUIPMENT

Number	Date of Issue	Title
1	January 29, 1991	Maximum-Minimum Temperature System (MMTS) Surge Protector Installation Instructions
2	September 26, 1995	Gear Set Change for the Dual Traverse Universal Precipitation Gauge

MAINTENANCE NOTE 1 (for Cooperative Program Managers)
Engineering Division
W/OS0321:BGM

Maximum-Minimum Temperature System (MMTS) Surge Protector Installation Instructions

General:

This maintenance note provides Cooperative Program Managers (CPM) the installation instructions for MMTS lightning protection. The instructions provide plans for *service* entrance installation, alternate service entrance installation and non-service entrance installation. The service entrance and alternate service entrance installation plans apply to new MMTS installations, while the non-service entrance installation plan applies to systems already installed. For new installations the ground configuration will determine which installation to use. Only one plan is to be used for each MMTS location.

Effects on Other Instructions:

None.

Procedure:

The instructions and procedures for installation of the lightning protection for the MMTS are attached.

CPMs have already received the primary protector enclosure, primary protector, MOV assembly, and GRN/YEL ground wire, to be installed on the sensor cable. The Engineering Division will send the CPMs the AC surge protectors and replacement cable to run from the protector to the display unit. The replacement is necessary because the existing cable is not flexible enough.

CAUTION

Do not connect the ground wire to an outside water tap as this is not always properly grounded.

J. Michael St. Clair
Chief, Engineering Division

Attachment

MAXIMUM/MINIMUM TEMPERATURE SYSTEM (MMTS)
LIGHTNING PROTECTION INSTALLATION INSTRUCTIONS

NATIONAL WEATHER SERVICE
OFFICE OF SYSTEMS OPERATIONS
ENGINEERING DIVISION
JANUARY 1991

TABLE OF CONTENTS

LIST OF FIGURES

MAXIMUM/MINIMUN TEMPERATURE SYSTEMS (MMTS) LIGHTNING PROTECTION INSTALLATION PLAN

Purpose

This plan includes two separate installation schemes to provide lightning protection to the MMTS and its vicinity. They are the Service Entrance Installation Plan and the Non-Service Entrance Plan.

The Service Entrance Installation Plan is preferred for all locations. See Figure 1 for an overview. It provides the maximum protection for the MMTS, observer, and facility. The entry of the data lines at the service entrance enables the best arrangement for grounding the protector to the facility ground. This optimum grounding provides the least risk of shock, arcing, and MMTS damage. We recommend this plan for new MMTS installations.

The Non-Service Entrance Plan installs the surge protector at some distance from the building ground. See Figure 6 for an overview. The longer grounding conductor puts the MMTS at a different potential than other grounded items when the primary protector conducts. This potential difference increases the possibility of shock, arcing, and MMTS damage. Additionally, the Non-Service Entrance Installation Plan requires additional protection components not needed for the service entrance installation. Use the non-service entrance installation only when the service entrance installation method is not possible or economical. If the facility does not use a grounding type receptacle, that is, one with a third or grounding position, the non-service entrance plan cannot be used. The site must be reconfigured to a service entrance installation or be abandoned.

SERVICE ENTRANCE INSTALLATION

General

All new MMTS installations are to be installed so that the sensor cable enters the facility in close proximity to the AC power service entrance. A surge protector is installed inside the facility at this point. The protector is grounded to the facility ground. The cable from the MMTS sensor is terminated on the line side of the protector and the cable to the MMTS Display is connected on the load side of the protector. See Figure 1 for a typical installation and Figure 2 for a typical facility entrance hole and protector installation. The remainder of the instructions provide the details of the installation. The installation list of materials (LOM), appendix 2, should be reviewed to ensure that all necessary materials are available. Some materials are site specific and cannot be identified until the site has been visited and the installation details determined.

The protector installed by the telephone company on the phone lines is similar to the installation of the primary protector on the MMTS sensor lines. If the installation of the phone at a particular site has been done by a Bell System company, it can serve a reliable overview of the installation of the MMTS primary protector. Installation of other similar systems such as cable TV, TV satellite dishes and TV antennas shall not be used as an example.

The National Electric Code (NEC), 1987, was used extensively in developing this plan. While the NEC does not expressly cover this particular type of installation, this plan complies with the intent of all appropriate sections. The following is given as reference to aid in answering questions regarding code compliance.

The section of the NEC that best applies to our application is Article 800, Communication Circuits. Grounding system, bonding, and connections to grounding system are covered in Article 250. Of particular importance to this installation are Section G, Bonding; Section H, Grounding Electrode System; and Section K, Grounding Conductor Connection.

Protector Installation

Preinstallation Planning

1. Identify the ground point for the protection system. This is the most important step in the installation. Care in identifying the proper ground point is the best way to assure trouble free protector operation. The protector must be grounded to the facility or building grounding electrode system. The grounding electrode system is basically the building ground or ground system. The electrical service panel will, in almost all cases, be connected to the grounding electrode system by a grounding wire, called the grounding electrode conductor In most residences, the grounding electrode system or house ground is the metal cold water piping system. ground wire (the grounding electrode conductor) between the service

panel and the cold water piping system will confirm the piping system as the grounding electrode system, The grounding electrode conductor, if used, will have been previously installed. The CPM is not to install the grounding electrode conductor or any other connection inside the circuit breaker panel. The cold water piping system or grounding electrode conductor are adequate ground points. Select the one closest to the surge protector.

If the cold water pipe is selected, the grounding point on the cold water pipe system must not be separated from the service entrance grounding electrode conductor connection point by non conductive piping such as PVC pipe.

The grounding point used by the telephone system protector is a good guide to the identification of the proper grounding point. However it must meet the criteria of this step or appendix 1.

If the cold water system cannot be identified as the grounding electrode system, see appendix 1 for alternative grounding points.

If the building ground point cannot be positively identified, or if there is reason to doubt the quality of the ground, the advice of qualified electrician should be obtained.

After selecting the ground point, obtain an appropriate grounding clamp for that type of ground point. See figure 4 and the list of materials (appendix 2).

2. Select the protector location and sensor cable entrance points. Locate the protector to provide the shortest straight line grounding cable run to the grounding point selected above. The sensor cable entrance point must not bring the sensor cable within 6 inches of any conductive materials.

The installation must maintain at least 1 foot separation is maintained between the cable from a the sensor and the cable to the display. Entrance through exterior aluminum siding is permissible if done through an insulating bushing such as plastic pipe as shown in Figure 5. The protector should not be installed on a conductive surface.

Installation

1. Mount the surge protecter at the location selected above.

2. Mount the bonding clamp to the grounding point.

3. Make an opening in the facility structure at the cable entrance point. Slant the opening to prevent entry of water from the outside as shown in figure 2A. Install the insulating bushing if required. See figure 5.

4. Extend the sensor cable through the entry hole to the vicinity of the protector. Seal the entry hole on the outside and inside with silicone caulk. Install caulk so the cable is not touching the entry points to reduce possible cable chaffing. Support the cable run with appropriate clamps. Do not use staples on the sensor or display cables.

5. Terminate the two data conductors and drain wire with spade lugs and attach to the line side of the protector as shown in figure 3. Support the cable with a clamp as near as possible to the protector.

6. Install the MOV assembly on the line side of the protector.

7. Terminate the two data conductors of the cable from the MMTS Display with spade lugs and attach to the load side of the protector as shown in figure 3. The cable from the primary protector to the MMTS display can be run outside so long as it is not buried and a minimum separation of 1 foot from the sensor cable is maintained. The drain wire is optional, but if present, terminate as shown in figure 3. Support the cable with a clamp as near as possible to the protector. Do not run the display cable near the sensor cable (minimum of one foot).

8. Run the ground wire from the line side of the protector to the ground point. Any bends in the cable should be gradual rather than sharp right angles. Support the ground wire with staples or clamps. Attach the wire to the ground clamp. Terminate the other end with a spade lug and attach to the protector as shown in Figure 3.

9. Install the AC surge protector. See figure 1.

ALTERNATIVE SERVICE ENTRANCE PLAN

This plan applies to sites with an exterior ground rod installed by the power company as part of the AC power grounding system.

This plan installs the primary protector in an enclosure outside the facility. A pre-assembled enclosure will be provided. The sensor cable is terminated on the line side of the primary protector and extended from the load side of the primary protector into the facility to the MMTS display. A ground cable runs from the protector to the power company ground rod. See figure 8 for an overview of the installation. A sensor line clamping unit is not required. Ensure that local codes and power company policy allow such connection.

Protector Installation

1. Select the protector enclosure mounting location. It must be selected so that the ground cable run to the ground rod does not exceed 10 feet. The enclosure can be mounted on the facility or on a pipe using standard U-bolts.

2. Select the display cable entry point into the facility.

3. Using Drawing C450-5-SD002, select the sensor and display cable configuration that matches the site configuration. Install the protector into the box with the proper orientation.

4. Mount the enclosure.

5. Cut and strip back the sensor cable. Terminate the wires with spade lugs (LOM Item 12). Install the wires, MOV assembly, and protector ground lead (GRN/YEL) on the line side of the protector as shown on Drawing C450-5-SD002.

6. Run the display cable from the enclosure to the MMTS display unit location. Terminate the cable at the enclosure end with spade lugs and install on the load side per drawing C450-5-SD002. Ensure that the entry point is sloped to prevent water entry and sealed with silicon caulk (figure 2A). If the point is thorough aluminum siding, an insulator using plastic pipe must be used (figure 5).

7. Terminate the display end with the standard MMTS connector.

8. Install the ground rod clamp on the ground rod. It is of utmost importance that the AC Dower connection to the ground rod is not disturbed or changed in any way.

9. Run the ground wire (LOM Item 4) from the enclosure to the ground rod. Strip the insulation and install the enclosure end into the ground lug. Strip the rod end and install in the ground rod clamp.

10. Install and close the enclosure cover.

11. Plug the display cable into the MMTS display.

12. Install the AC surge protector. See figure 1.

NON-SERVICE ENTRANCE INSTALLATION PLAN

General

The Non-Service Entrance Installation Plan is for those Maximum/Minimum Temperature Systems (MMTS) already installed and new installations for which installation, in accordance with the Service Entrance Plan, is too expensive or is impractical.

In this plan, the primary protector is installed in a rain tight enclosure outside the facility near the point where the sensor cable enters the facility. The enclosure, primary protectors, and associated hardware have been preassembled and provided to the Cooperative Program Manager (CPM). The cable from the sensor is cut and terminated on the line side of the primary protector. A new cable is terminated on the load side of the protector and run to the MMTS display. The new cable has been provided to each CPM. A ground cable is run from the grounding lug in the enclosure to the facility ground. The plan makes provision for a sensor line clamping unit which will be provided at a later date. The installation, when done according to this plan, provides easy installation of the sensor line clamping unit. The installation of the clamping unit can be done by the observer in most cases. See figure 6 for an overview of a typical complete installation. See figure 7a for the configuration after the primary protector installation and 7b for the configuration after the sensor line clamping unit installation. The remainder of the instructions provide the details of the installation. The installation list of materials (LOM), appendix 3, should be reviewed to ensure that all necessary materials are available. Some materials are site specific and cannot be identified until the site has been visited and the installation details determined.

The National Electric Code (NEC), 1987, was used extensively in developing this plan. While the NEC does not expressly cover this particular type of installation, this plan complies with the intent of all appropriate sections. The following is given as reference to aid in answering questions regarding code compliance.

The section of the NEC that best applies to our application is Article 800, Communication Circuits. Grounding system, bonding, and connections to grounding system are covered in Article 250. Of particular importance to this installation are Section G, Bonding; Section H, Grounding Electrode System; and Section K, Grounding Conductor Connection.

Protector Installation

Preinstallation Planning

1. Ensure that a grounding type AC receptacle, that is, one with a third or grounding position is available for the MMTS display. If it is not available, or cannot be provided, the site must be reconfigured to a service entrance type installation or abandoned.

2. Use the AC circuit tested (LOM Item 9) to test the AC receptacle to be used for the MMTS. Following the instructions provided with the tester. If the AC receptacle does not check correctly, the circuit must be corrected by a qualified electrician.

3. Identify the ground point for the protection system. This is the most important step in the installation. Care in identifying the proper ground point is the best way to assure trouble free protector operation. The protector must be grounded to the facility or building grounding electrode system. Connection to the grounding electrode system must be made only in the service entrance area. The grounding electrode system is basically the building ground or ground system. The electrical service panel will, in almost all cases, be connected to the grounding electrode system by a grounding wire, called the grounding electrode conductor In most residences, the grounding electrode system or house ground is the metal cold water piping system. A ground wire (the grounding electrode conductor) between the service panel and the cold water piping system will confirm the piping system as the grounding electrode system. The grounding electrode conductor, if used, will have been previously installed. The CPM is not to install the grounding electrode conductor or any other connection inside the circuit breaker panel. The cold water piping system or grounding electrode conductor are adequate ground points. Select the one closest to the surge protector.

   If the cold water pipe is selected, the grounding point on the cold water pipe system must not be separated from the service entrance grounding electrode conductor connection point by non conductive piping such as PVC pipe.

   The grounding point used by the telephone system protector is a good guide to the identification of the proper grounding point. However it must meet the criteria of this step or Appendix I.

   If the cold water system cannot be identified as the grounding electrode system, see appendix 1 for alternative grounding points.

   An external ground rod installed by the power company as a part of the AC power ground system can be used for the ground point.

   If the building ground point cannot be positively identified, or if there is reason to doubt the quality of the ground, the advice of a qualified electrician should be obtained.

   After selecting the ground point, obtain an appropriate grounding clamp for that type of ground point. See figure 4 and the list of materials, appendix 3.

4. Select the primary protector enclosure location. For existing MMTS locations, this will be the area where the sensor cable comes from underground to enter the facility. The enclosure is designed to be

installed on the exterior of the facility or on a post using standard U-bolts. The location should be chosen to make the best possible cable run into the facility and ground cable run exterior to the facility to the service entrance area.

Installation

1. Using drawing C450-5-SD002, determine which cable configuration best suits your installation. Install the protector in the box in the proper orientation.

2. Mount the bonding clamp to the grounding point identified previously.

3. Cut and strip back the sensor cable. Terminate the wires using LOM Item #4. Terminate the sensor cable, install the MOV assembly and protector ground lead (GRN/YEL) on the line side of the protector as shown on drawing C450-5-SD002.

4. Install a display data cable (LOM Item #2) from the protector enclosure into the facility. The cable length is critical to the future installation of the sensor line clamping unit. The sensor line clamping unit will be installed in the AC power receptacle used by the MMTS. Figure 7A shows the configuration after the primary protector installation prior to installation of the sensor line clamping unit. Cut display cable so that it will reach the future location of the clamping unit as well as the location of the MMTS. Terminate the cable with the standard MMTS display connector. The sensor line clamping unit will be equipped with a connector that will mate with the sensor cable. The sensor line clamping unit will be equipped with a IO-foot cable to go the the display. See figure 7B for configuration after sensor line clamping unit installation.

5. Terminate the display data cable on the load side of the primary protector in the enclosure as shown on Drawing C450-5-SD002.

6. For an external ground rod (see Preinstallation Planning Section) run the ground cable (LOM Item #5) from the enclosure to the ground rod. Strip the insulation and attach the wire to the ground clamp. <u>It is of upmost importance that the AC Power connection to the ground rod is not disturbed or changed in any way</u>. Go to step 10.

7. For an indoor ground point connection, provide an opening in the facility structure to extend the ground cable to the grounding point identified earlier. If a special opening is required, slant it to prevent entry of water from the outside as shown in Figure 2A.

8. Extend the ground wire (LOM Item #5) through the opening to the vicinity of the ground point. Strip the insulation and attached it to the ground clamp. Support the wire where required with clamps or staples. Seal the entry on the outside and inside with silicon caulking.

9. Strip the insulation and attach the ground wire to the grounding lug as shown on Drawing C450-5-SD002.

10. Install the AC surge protector (LOM Item #3) into the lower receptacle of the AC duplex.

11. Plug the MMTS display into one of the receptacles of the AC surge protector.

12. Plug the display data cable into the MMTS display.

Appendix 1
GROUND IDENTIFICATION GUIDANCE

The following, which is paraphased from the National Electric Code (NEC, 1987), is provided as guidance in the identification and selection of a grounding point. If a grounding point cannot be postively identified, assistance from an electrical contractor is recommended.

a. The building or structure grounding electrode system. The grounding electrode system, in general, consists of the following items (when available) bonded together by jumpers: metal underground water pipe, grounded metal frame of building, concrete-encased electrode, or ground ring. These bonded items will be connected to the service entrance box by a grounding electrode conductor. In a residence, all this normally reduces to the metal cold water piping system which is connected to the service entrance by a grounding electrode conductor. Any of the above items, when it is certain that they are part of the grounding electrode system, are suitable as the grounding point. For example, if the cold water piping system is the grounding electrode system as indicated by its connection by grounding electrode conductor to the service entrance, then the point on the cold water piping system nearest the protector is the proper grounding point. However, the grounding point must not be separated from the service entrance grounding electrode connection point by nonconducting piping such as PVC piping.

b. The power service accessible means external to the enclosure. The National Electric Code (Section 250-71b) specifies that for dwellings a provision for connecting grounding conductors external to the enclosures is to be provided. In addition to the metallic power service raceway and the grounding electrode conductor covered in the next paragraphs, provisions for other approved means is given. An example of the approved means is a #6 AWG copper conductor bonded to the service equipment and made accessible on the outside wall of the dwelling. (NEC Section 250-71b(3)).

C. The metallic power service raceway (not normally used in a residence).

d. The grounding electrode conductor or the grounding electrode conductor enclosure. (The conductor enclosure is not normally used in residences.)

e. The service entrance enclosure. This grounding point should only be used if no other grounding point is available. Entry into the enclosure is not normally allowed except by an authorized electrician. The means of connection must be an approved means.

f. If none of the above are available, then an effectively grounded metal structure may be used or a continuous and extensive underground metal gas piping system which is acceptable to the gas supplier and the authority having jurisdiction may be used. Steam or hot water pipes may not be used.

Appendix 2
LIST OF MATERIALS
SERVICE ENTRANCE INSTALLATION

1. Primary protector, available in NWS stock. NWS Catalog No. C460-4, Verite Part No. DL1525. The initial installation units will be provided to. each CPM.

2. Spade lug for #20 and #22 AWG wire, crimp on type, #6 stud size.
Amp Part No. 32562

Panduit Part No. PV18-6F-C
or
*equal

3. Spade lug, for #12 AWG wire, crimp on type, #6 stud size.
Amp Part No. 324581

Thomas and Betts Part No. RC10-6F
or
*equal

*Radio Shack crimp on lugs are acceptable if they match the wire and stud size.

4. Copper wire, #12 AWG, solid insulated, green or green with yellow stripe, standard house wiring acceptable.

5. Cable clamp, for l/l-inch diameter cable,
SPC Part No. ECC-4
or
equal

6. Staples, uninsulated or insulated, suitable for LOM, Item #4.

7. Ground clamp, metal water pipe type, shown in Figure 4A. Suitable for the pipe size and pipe material used as ground point.

8. Ground clamp, split bolt type, shown in Figure 4B, sized for the grounding electrode conductor and #12 AWG wire. If the grounding electrode conductor is aluminum, the clamp must be suitable for both aluminum and copper.

9. Metal Oxide Varistor (MOV) assembly, NWS Catalog No. C460-3. Initial installation units provided to each CPM.

10. AC surge protector, NWS Catalog No. C460-2. Kalglo Electronics Co., Inc., Model MINI II. Provided to each CPM.

11. Primary protector enclosure. Includes primary protector, MOV assembly, and GRN/YEL ground wire. Previously shipped to each CPM. (Use for alternative service entrance installation only.)

Appendix 3
LIST OF MATERIALS
NON-SERVICE ENTRANCE INSTALLATION

1. Primary protector enclosure. Includes primary protector, MOV assembly and GRN/YEL ground wire. Previously shipped to each CPM.

2. Cable, silicone rubber insulated, Belden 83394. NWS Catalog No. C460-1W1. Rolls of 100' provided to each CPM.

3. AC surge protector. NWS Catalog No. C460-2. Kalgio Electronics Company, Inc., Model MINI II provided to each CPM.

4. Spade lug for #20 and #22 AWG wire, crimp on type, #6 stud size.
   Amp Part No. 32562

   Panduit Part No. PV18-6F-C
   or
   equal (Radio Shack crimp on lugs are acceptable if they match the wire and stud size.

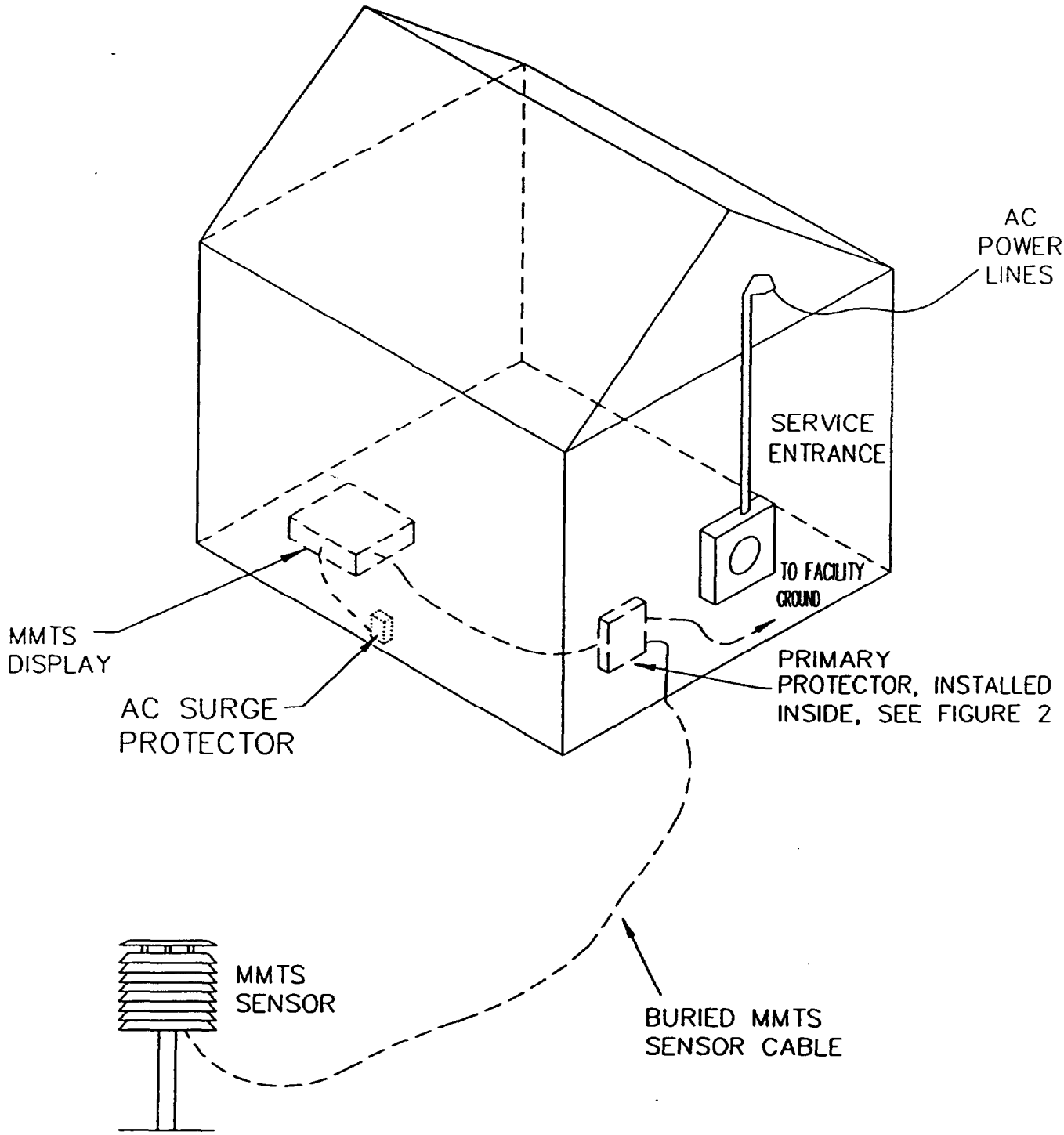
5. Copper wire, #6 AWG, solid, insulated.

6. Staples, uninsulated or insulated, suitable for LOM, Item #5.

7. Ground clamp, metal water pipe type, shown in figure 4A. Suitable for the pipe size and pipe material used as ground point.

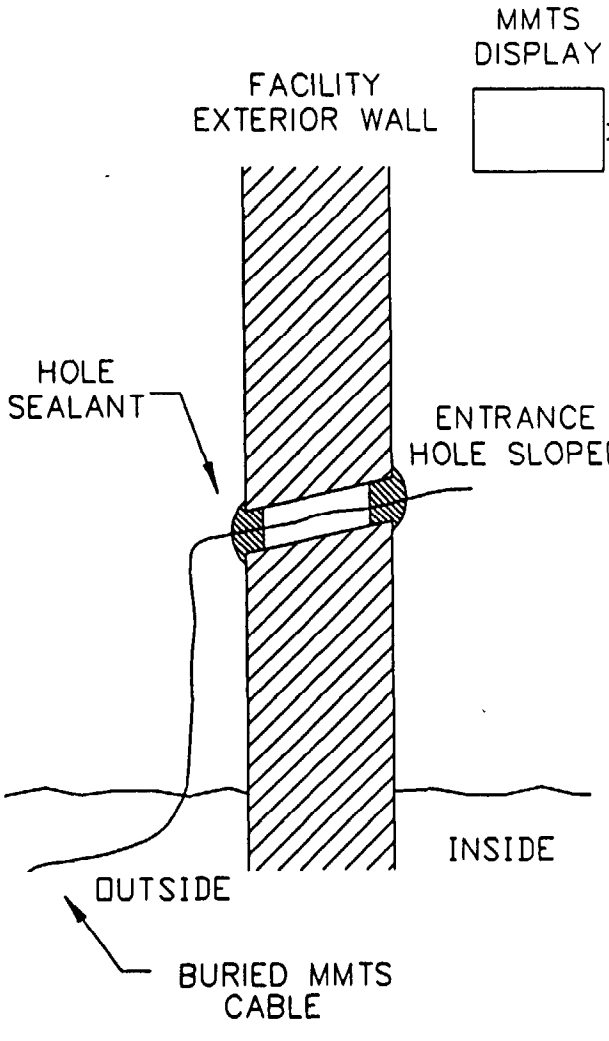
8. Ground clamp, split bolt type, shown in figure 4B, sized for the grounding electrode conductor and X12 AWG wire. If the grounding electrode conductor is aluminum, the clamp must be suitable for both aluminum and copper.

9. AC outlet analyzer, Radio Shack (MICRONTA), Catalog No. 22-101 or equal.



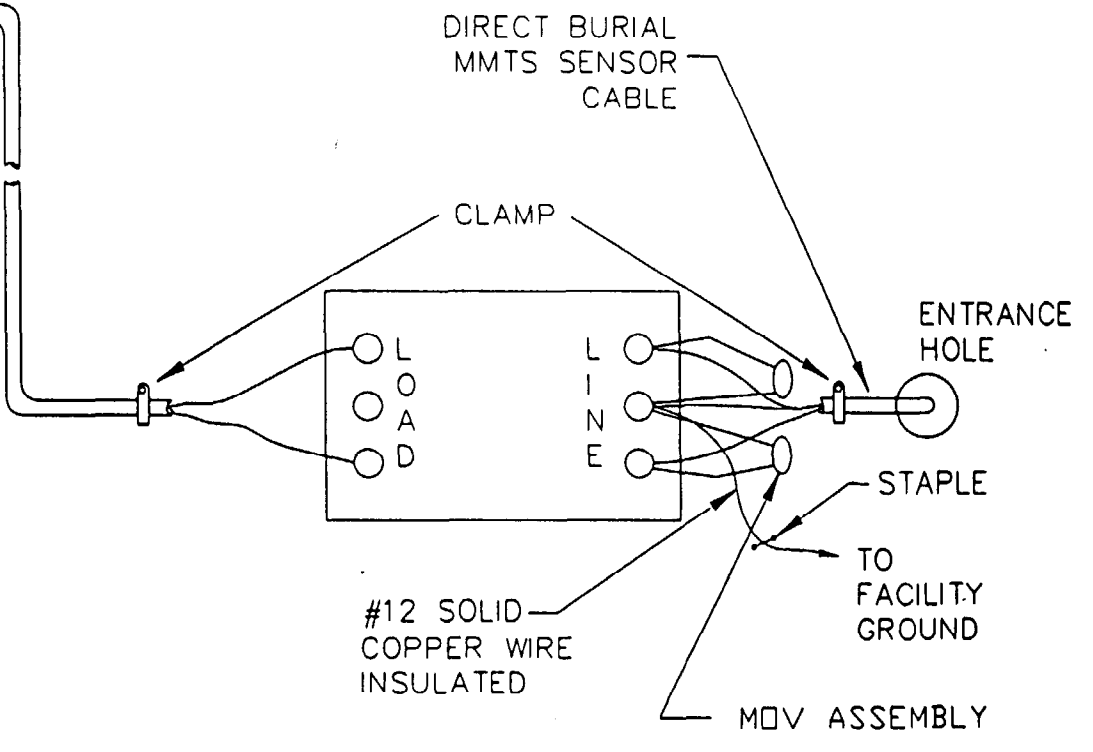
SERVICE ENTRANCE INSTALLATION

FIGURE 1



FACILITY ENTRANCE

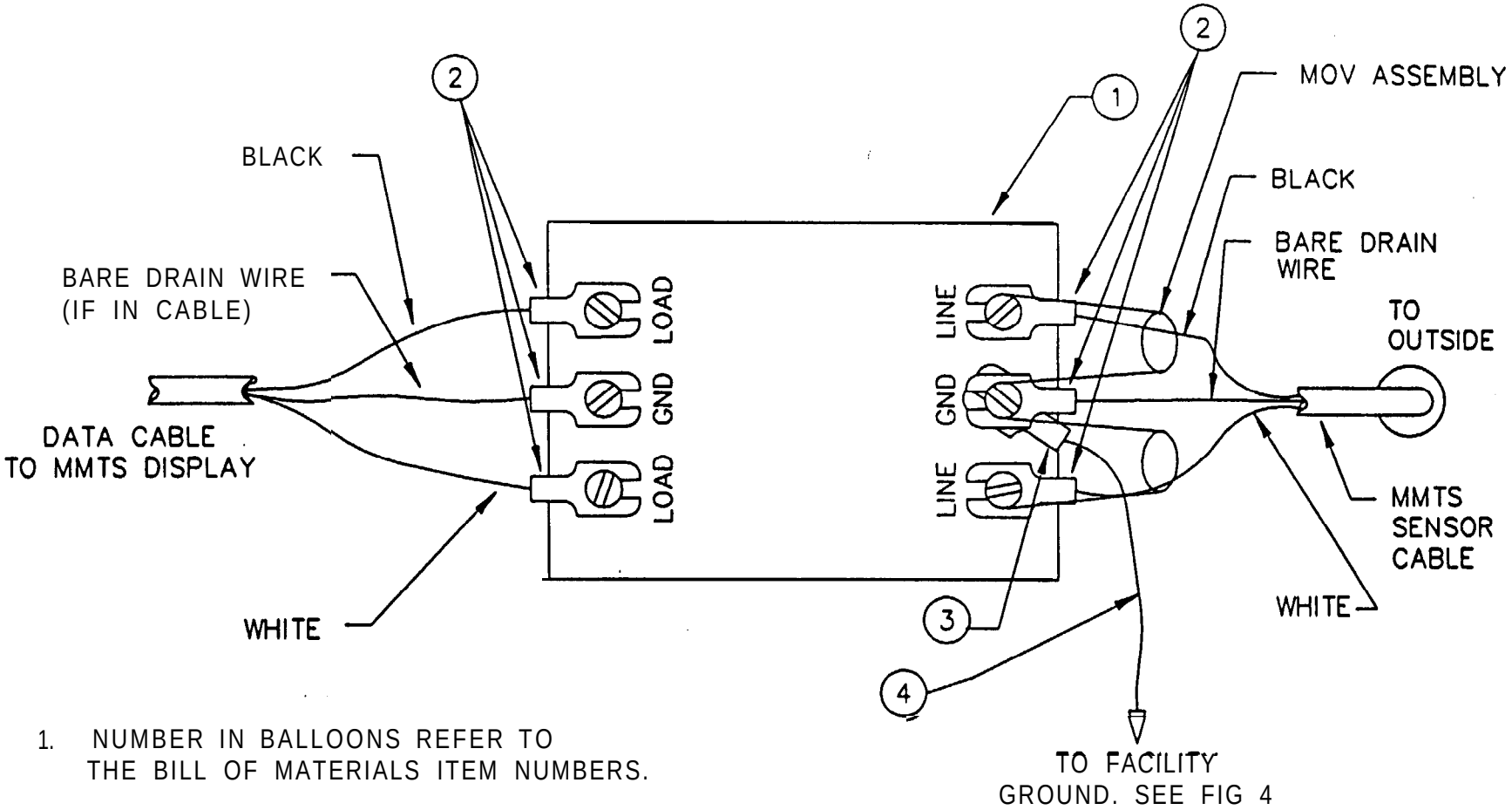
FIGURE 2A



PRIMARY PROTECTOR INSTALLATION

FIGURE 2B

F2MMTS



1. NUMBER IN BALLOONS REFER TO THE BILL OF MATERIALS ITEM NUMBERS.

PRIMARY PROTECTOR WIRING

FIGURE 3

F3MMTS

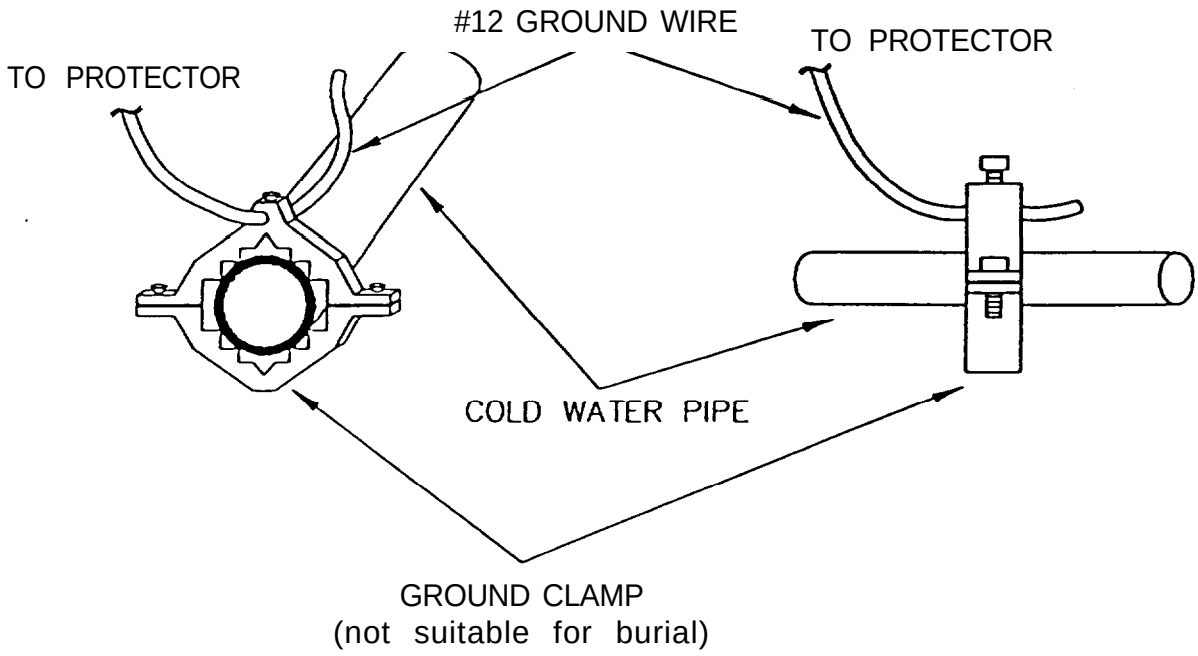


FIGURE 4A. Clamp used to connect to grounded cold pipe.

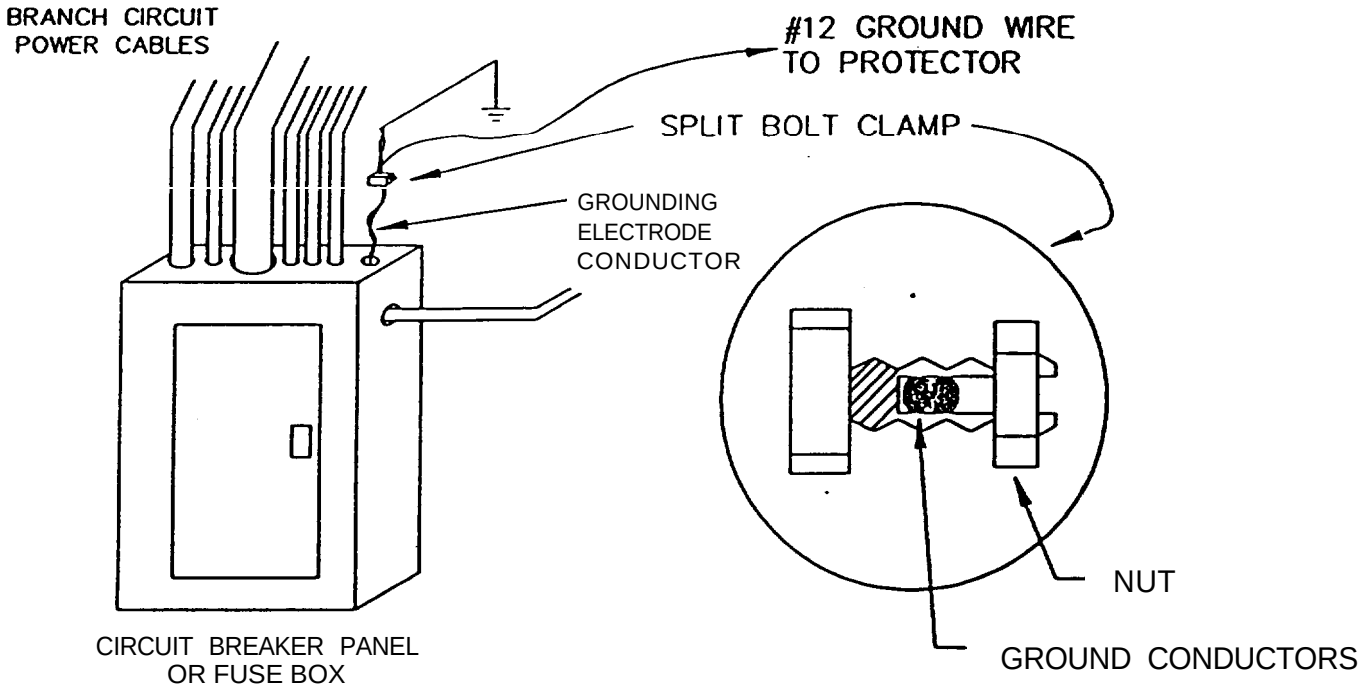
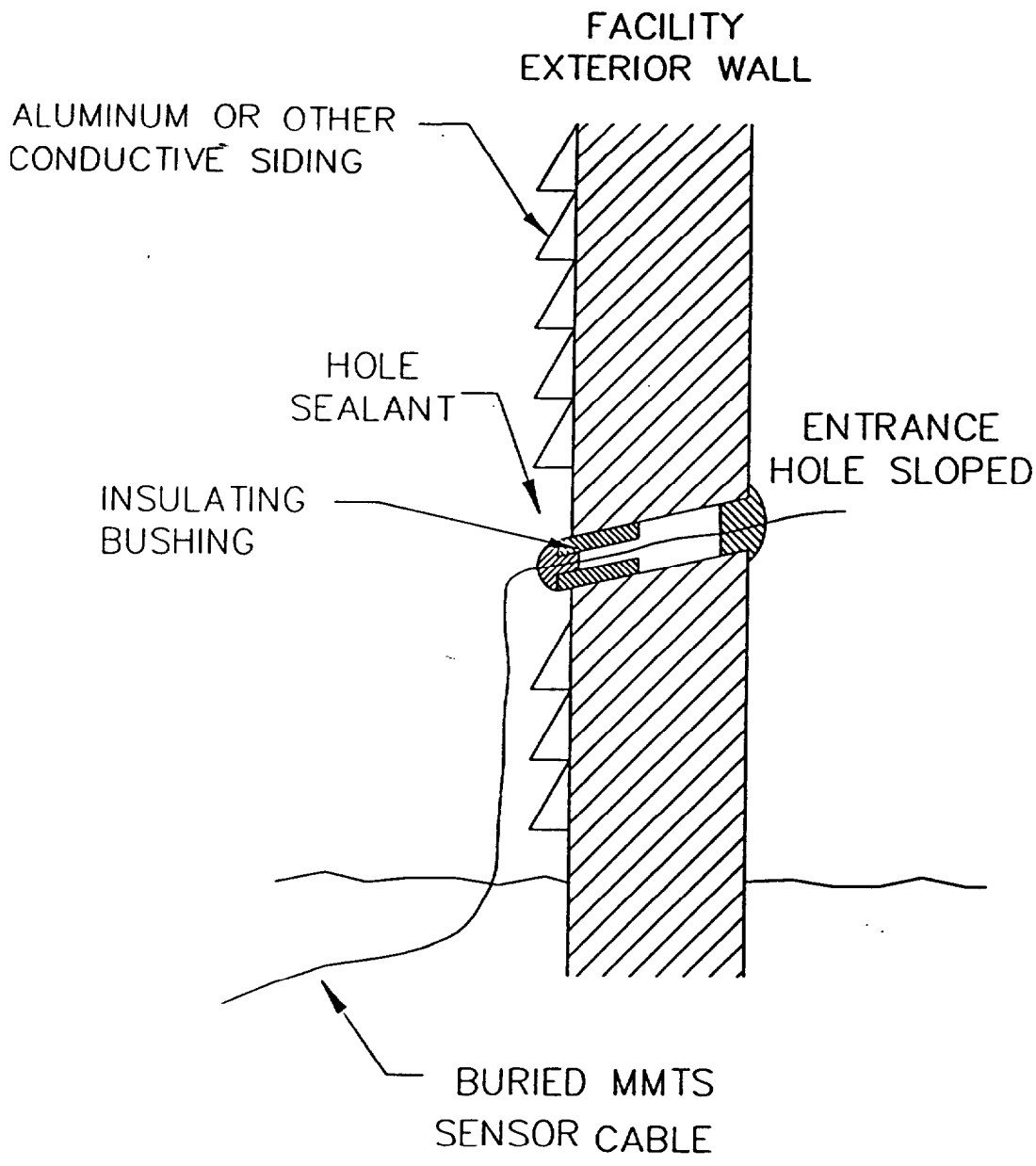


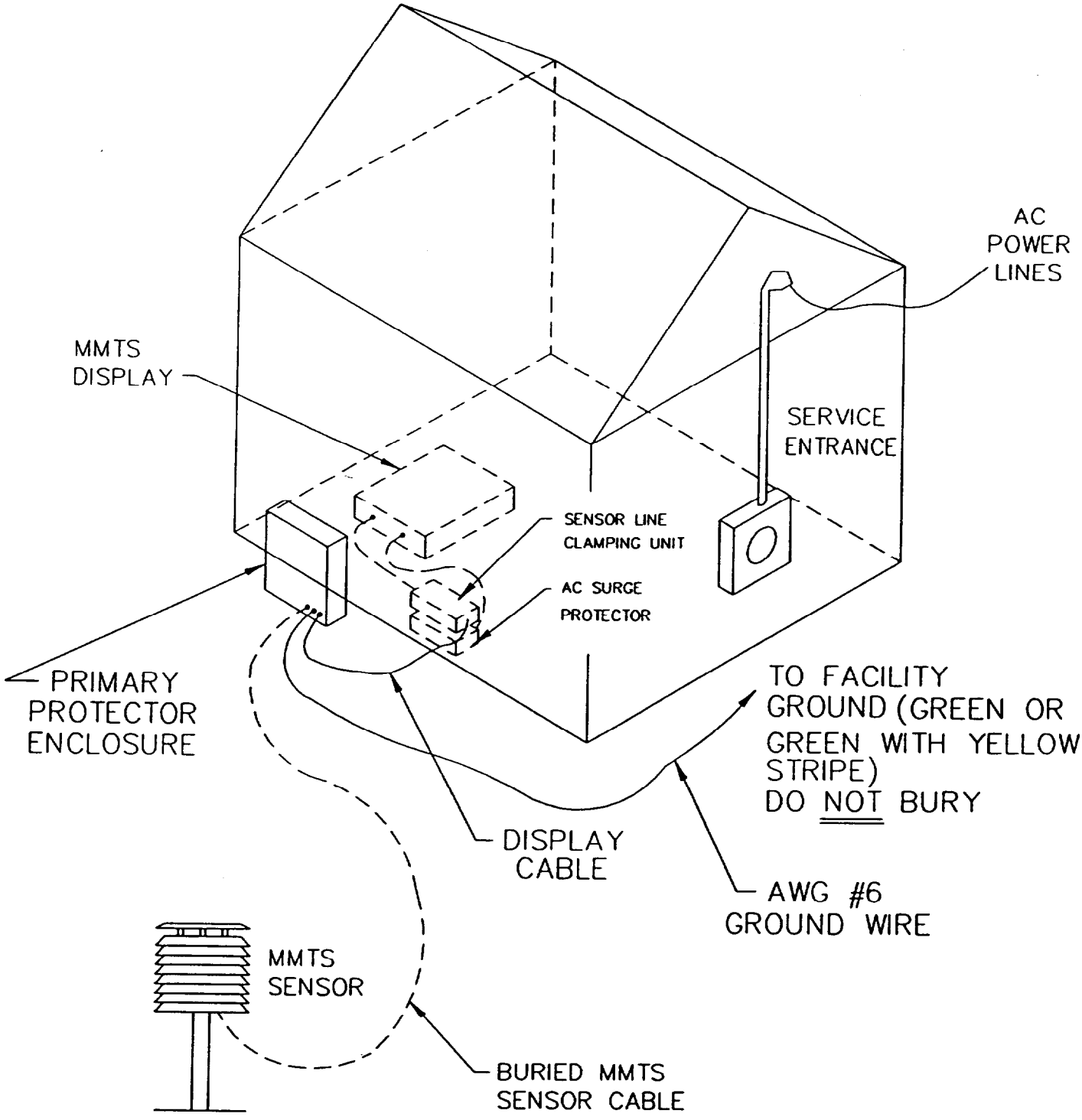
FIGURE 4B. Connection to grounding electrode conductor.

F4MMTS



CABLE ENTRANCE DETAILS
FIGURE 5

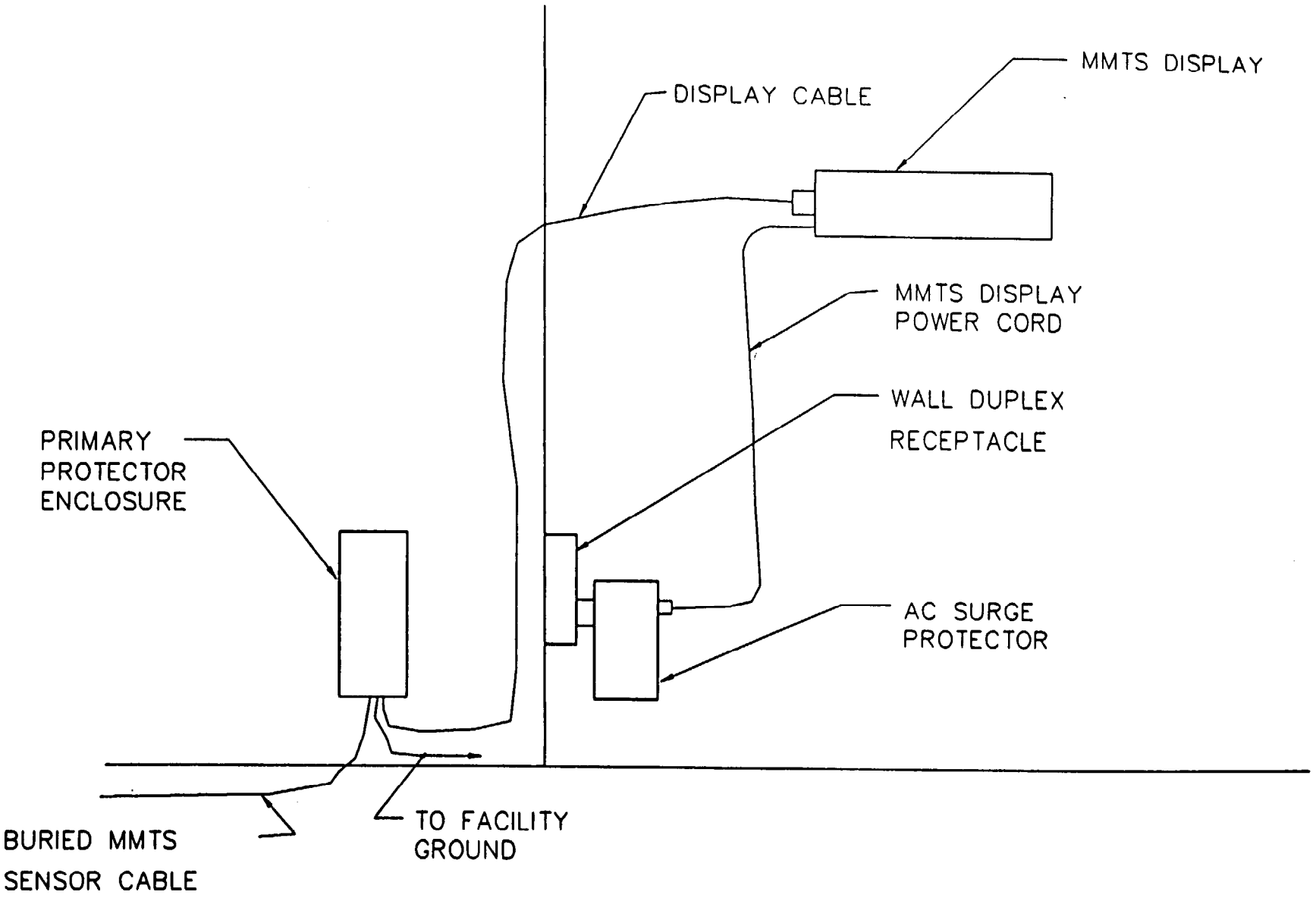
F5MMTS



NON SERVICE ENTRANCE INSTALLATION

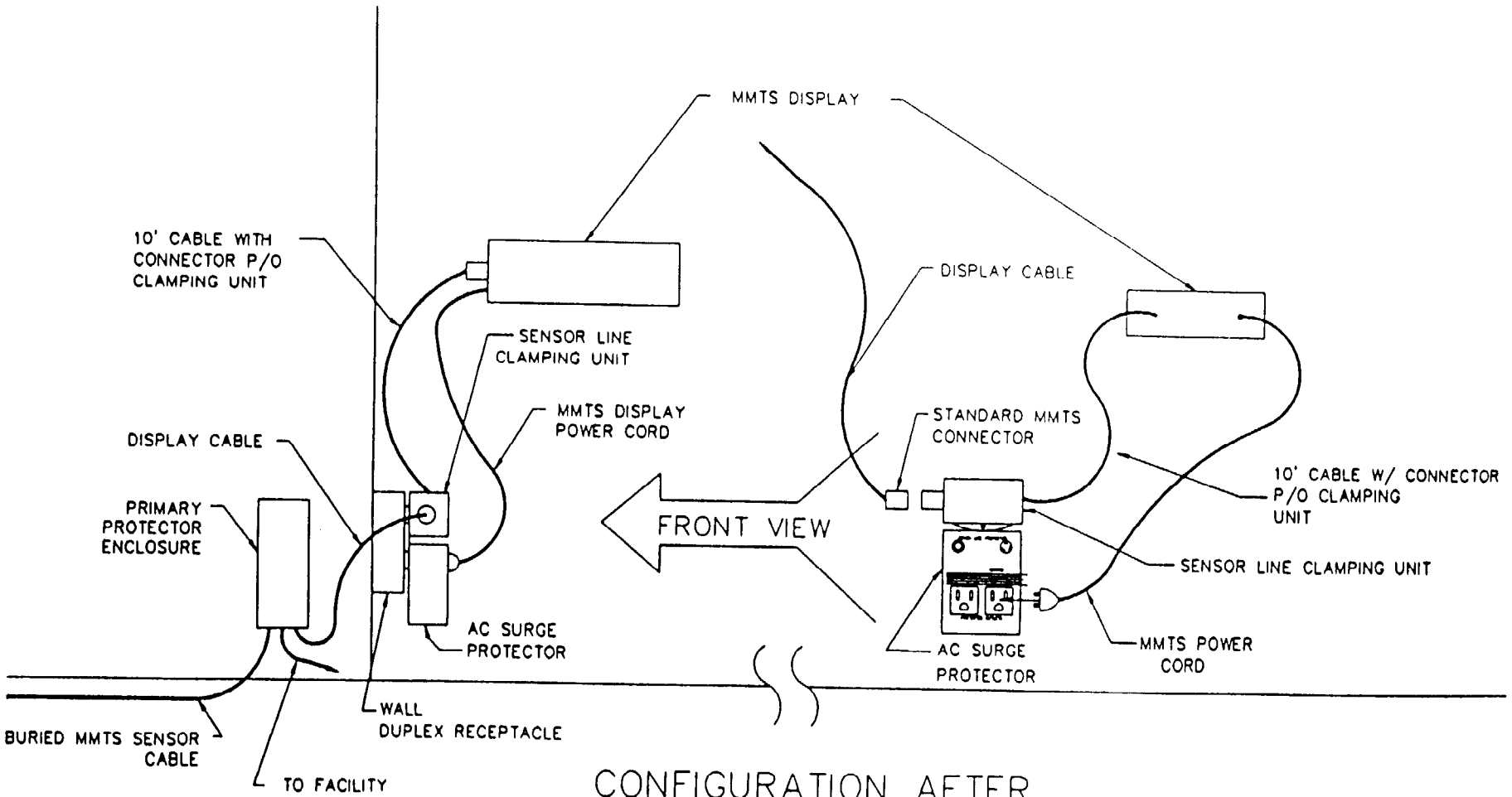
FIGURE 6

F6MMTS

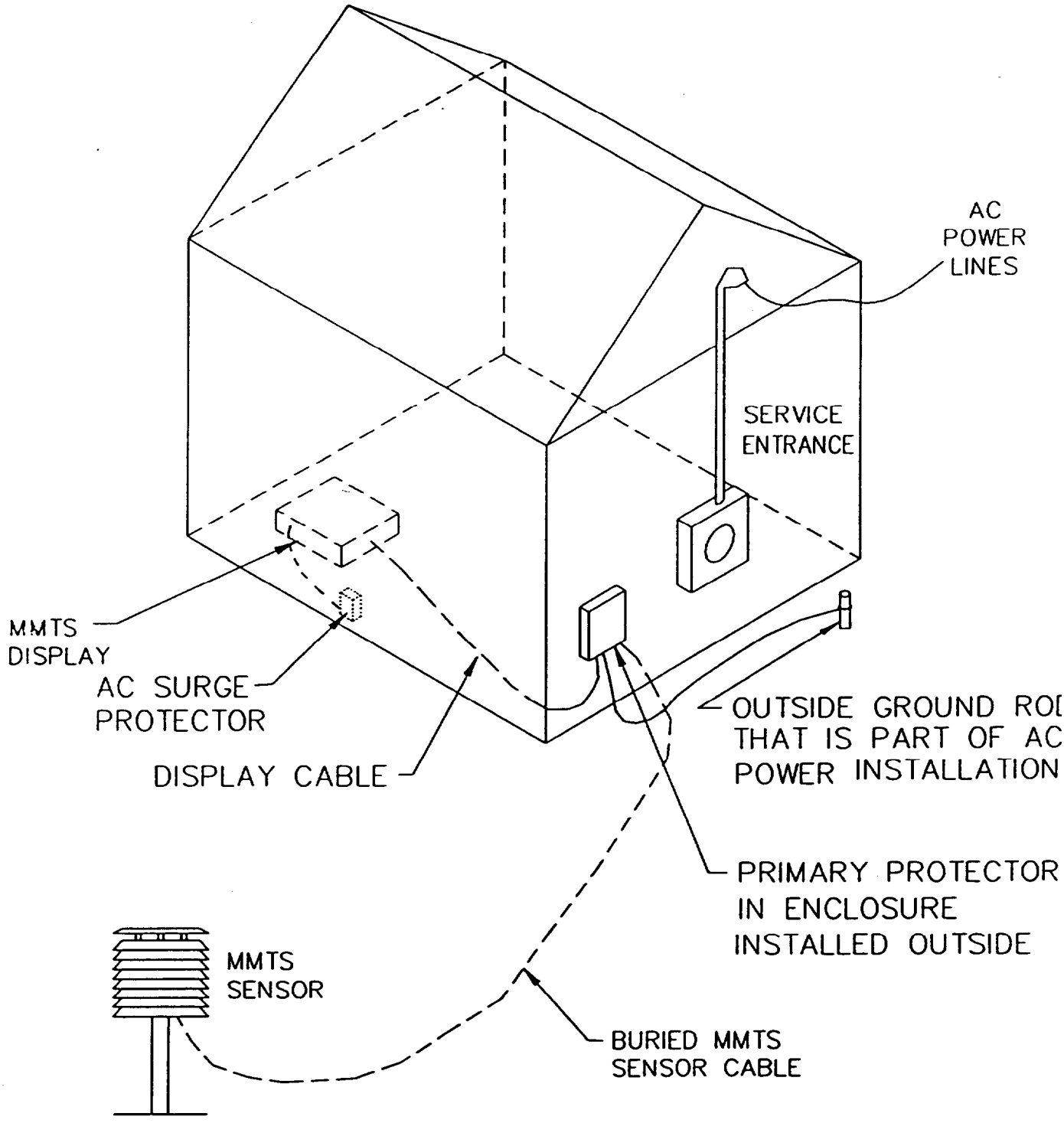


CONFIGURATION AFTER PRIMARY PROTECTOR INSTALLATION

FIG 7A



CONFIGURATION AFTER
SENSOR LINE CLAMPING UNIT INSTALLATION FIG 7B



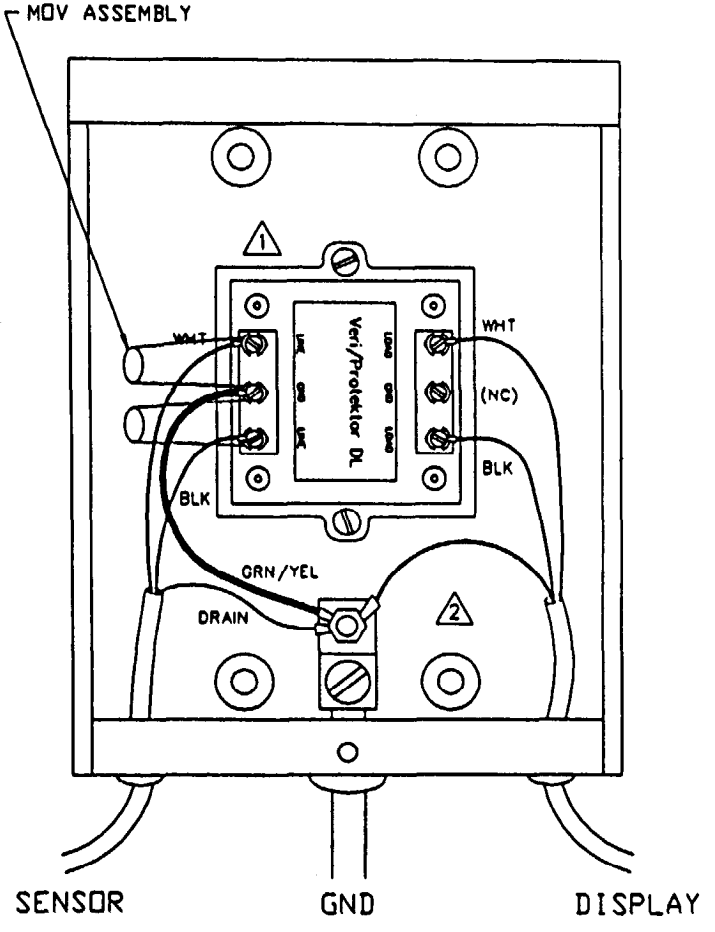
ALTERNATIVE

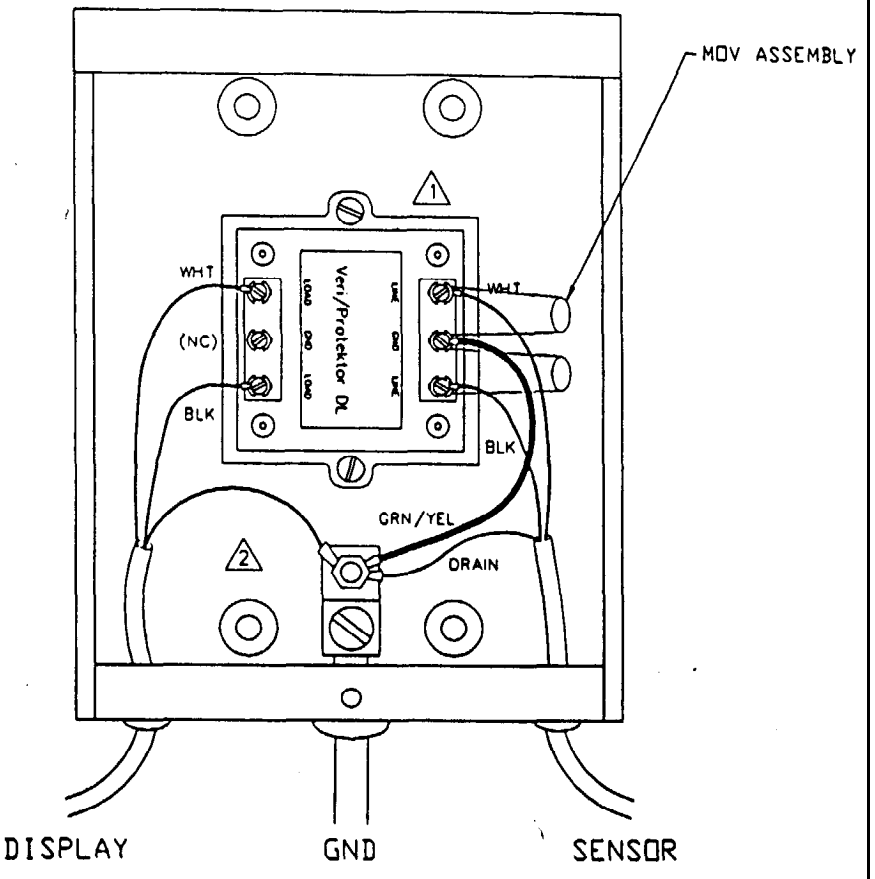
SERVICE ENTRANCE INSTALLATION

FIGURE 8

F1MMTS

REVISIONS				
ZONE	LTR.	DESCRIPTION	DATE	APPD





NOTES

1. TWO CONFIGURATIONS SHOWN GIVE BEST PROTECTION. DO NOT CROSS SIGNAL CABLES WITHIN OR OUTSIDE ENCLOSURE.

2. IF DISPLAY CABLE IS SHIELDED, ATTACH DRAIN WIRE TO GROUND LUG AS SHOWN.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±.5°
3 PLACE DEC. ±.005
2 PLACE DEC. ±.02

ENGINEERING DIVISION
SILVER SPRING MD. 20910

PREPARED	J.J.W.	11/8/88
CHECKED		
DESIGN		
APPROVED BY		

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

MAX\MIN TEMPERATURE SYSTEM PRIMARY SURGE PROTECTOR ENCLOSURE WIRING

SIZE	DATE	DRAWING NO.
C	A	C450-5-SD002

SCALE NONE SHEET: 1 of 1 FILE: C4505SD2

HYDROLOGIC GAGING (for Cooperative Program Managers)
MAINTENANCE NOTE 2
Engineering Division
W/OS0321:BGM

Gear Set Change for the Dual Traverse Universal Precipitation Gauge.

General:

The purpose of this maintenance note is to provide instructions for changing the 24-hour gear set now in use to the 8-day 192-hour gear set. This change allows the NWS staff maintaining the universal precipitation gauge the option to use the 8-day 192-hour gear set.

The gear set and chart can be ordered from the NLSC using ASNs:

ASN	Description
D110-3-1	Belfort part number 5572-192 (Cylinder gear)
D110-3-2	Belfort part number 5574-192 (Pinion gear)
D110-3-3	Belfort part number 5-4046-B (Chart)

Effects on Other Instructions:

None

Procedure:

1. Loosen the knurled thumbnut at the top of the chart cylinder and remove the chart cylinder. Reference Figure 1 for location of the chart drive cylinder and the chart drive movement.

   NOTE :
   The drive gear is friction fitted to the lower end of the chart cylinder.

2. Remove the existing 24-hour time scale gear beneath the cylinder and replace it with the 192-hour time scale gear (ASN: D110-3-1; Belfort P/N 5572-192).

3. Remove the 24-hour time scale pinion gear from the chart drive movement and replace with the 192-hour time scale gear (ASN: D110-3-2; Belfort P/N 5574-192).

NOTE:
The location and gear type is marked on the chart drive movement.

4. Remove the existing chart by first removing the chart clip from the chart cylinder. Then remove the chart.

5. **MOUNTING THE CHART.**
Apply the chart (ASN D110-3-3; Belfort P/N 5-4046-B) to the chart drum. Wrap the chart around the cylinder so that time reads from left to right and make sure the lower edge of the chart rests squarely on the flange at the bottom of the cylinder. While holding the chart, slide the metal chart retainer into the slot in the chart drum flange and also into the recess in the upper rim. Be sure to start the wrap so the beginning of the chart is at the right hand side of the flange slot. The chart will then overlap the identification tab and end with the narrow right hand margin immediately under the clip.

NOTE:
The chart drive movement is an 8-day version and will run a full week on one winding.

6. **WINDING**
The chart drive mechanism is wound by operating by operating the winding lever back and forth. Do not overwind - stop winding as soon as solid resistance of the mainspring is felt.

7. Replace the chart cylinder. Gently lower it straight down. The drive gears must be meshed as the cylinder is lowered into operating position. Do not force the cylinder into place. Rotate the cylinder slightly as the gears make contact and they will slide into place. Replace the knurled thumbnut at the top of the mechanism spindle.

8. **SETTING TIME**
To set the recorder to time, rotate the chart cylinder clockwise by hand until the desired time line is a little to the left of the pen, then counterclockwise to the proper

time setting. Always make the final time setting by turning the cylinder counterclockwise as this removes the effect of any backlash in the drive gearing.

Dominic Bosco

Acting Chief, Engineering Division

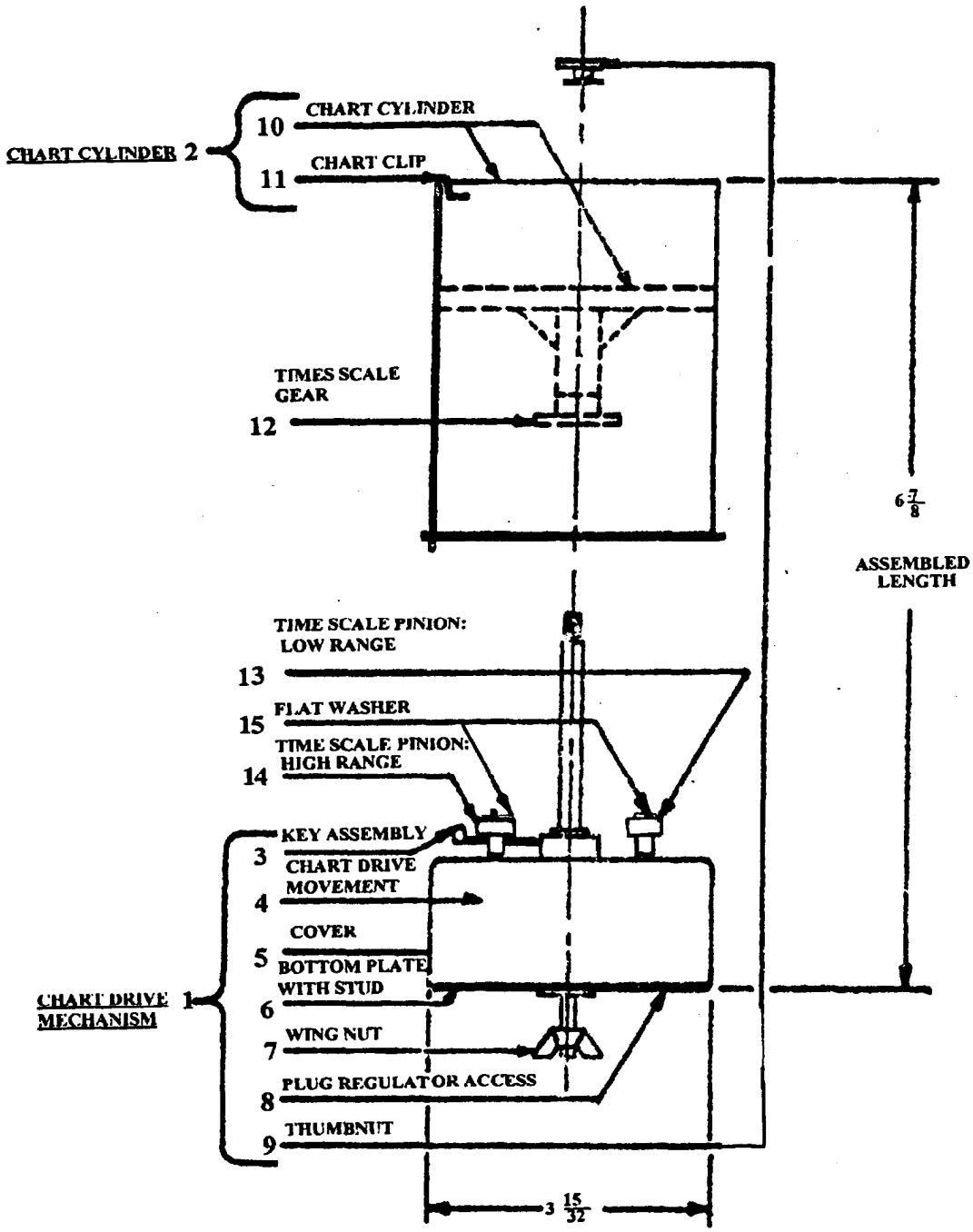


Figure 1

CHART DRIVE ASSEMBLY